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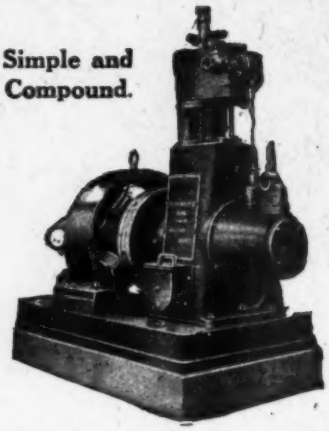

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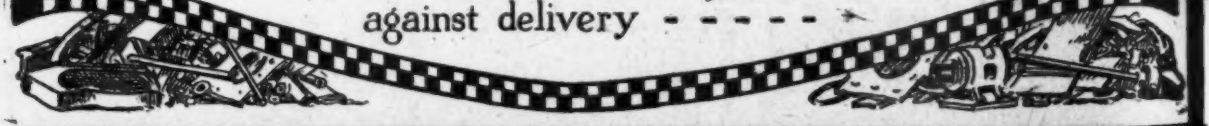

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ELECTRICAL REVIEW.

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THE PRICE OF THE "ELECTRICAL REVIEW."

During the War, almost exceptionally among technical publications and periodicals of the character of the ELECTRICAL REVIEW, we have refrained from increasing the price. Owing, however, to the constant increases in cost of paper, printing, engraving and production charges generally, we have reluctantly decided that the price from the beginning of next year must be raised to 6d. per copy. The change will not apply to unexpired subscriptions.

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THE CHANGING INDUSTRIAL POSITION IN INDIA.

WE commend to the serious attention of all British electrical and other engineering firms who are interested in the recovery of our trade position in India, a special report* which has been made to the Government by H.M. Senior Trade Commissioner, Mr. Thomas M. Ainscough, O.B.E.

In our electrical export trade in pre-war years India occupied a very large place. For the year 1913 that trade aggregated £1,769,000, nearly £500,000 more than the total for Australia and New Zealand. The following year was a broken one, owing to the war, and the total fell away to £784,000. During later years, as both trade manufacturing at home and sea transportation difficulties between this country and the East became acute, Indian purchasers were driven to place their orders elsewhere, and the United States and Japan were alive to the opportunity: of course the Indian buyers were greatly relieved at having these sources of supply to which to turn for filling their very pressing requirements.

The figures which we set out in tabular form on another page to-day, will show at a glance how between 1914 and 1918 our own electrical exports to India fell, and those of Japan, the United States, and in some cases those of Holland, increased. The greatest successes of Japan appear to lie in electric wires and cables, wrought brass, and copper goods, while the United States have done well in iron wire, electrical and other machinery, prime-movers and motors, electric fans, and scientific instruments. In most of the items, however, the big difference between our own exports in the years 1914 and 1918 has not been made up for by anybody else. There is unquestionably a shortage if one can regard the 1914 demand for imports as an example of India's requirements in 1918. The figures for the current year when Japan has been probably taking advantage to the full of the opportunity while it lasted, when the U.S. electrical export figures have been, until recent months, at any rate, scoring records, and when British shipping to India has been making heroic efforts to return to the normal, should be interesting.

If we widen our study to embrace the whole of our export trade to India in pre-war days in order to indicate the great importance that the country possessed for us as a market for our products, we find that the total value was £70,000,000 in 1913, of which 96 per cent. represented manufactured articles. In that year 16 per cent. of the total exports of

* Report on "Conditions and Prospects of British Trade in India at the close of the War." Cmd. 412. Price 2s. H.M. Stationery Office.

United Kingdom manufactured goods were shipped to India; metals and machinery were included therein amounting to £17,000,000, or 25 per cent. of the total. These figures represent the former purchasing power of India in British engineering and iron and steel manufactures. The same goods to-day would, of course, cost a vastly greater sum, and for that reason there is little usefulness in comparisons of pre-war and present export values. But the figures given, impressive as they are, are small compared with what our trade might have become had there been no interruption due to war, as Indian industrial development had little more than begun. There is probably no part of the British Colonies or Dependencies which holds a more brilliant possibility from the trade point of view, as if the modern movement in India progresses her vast population will almost certainly increase its demands upon us.

The foregoing circumstances, upon which it should be unnecessary to enlarge, render it most necessary that we should know as correctly as possible what is the situation of affairs to-day so that we may study our own position in relation to it, and intelligently develop an appropriate and far-seeing policy. Mr. Ainscough's report is of value in this connection.

It would appear that in framing our foreign trade schemes we have to be prepared to abandon many of our old conceptions. We are in the midst of change at home, but we must know that change is not limited to home or to European countries. We are assured that "*conditions in India to-day are totally different from those obtaining before the war.*" The country is in the throes of an "industrial rebirth," says the Commissioner. What is the trend of things, and what does "industrial rebirth" portend? One tendency is seen in the determination of buyers to purchase locally-made goods wherever possible. Our readers are already familiar with the similar tendency that is present in Australia, where every effort is being made to stimulate local industrial production. It is not for us at home to discourage such tendencies or to belittle them; yet in some departments the volume of new local production may not provide more than the amount of the normal increase; in others local manufacturing will be economically impracticable. Another point to observe is the greater and sustained intensity of foreign competition that is anticipated in India. In the past our trade position in India was not so seriously assaulted by foreign influences as was the case with some of our markets; it is not safe to reckon upon any such secure position in the future. Competition from the United States in machinery, metals, hardware accessories, cables, and other lines is expected to be more severe. We are assured by Mr. Ainscough that both the United States and Japan have greatly developed their shipping, financing and distributing organisations, and their representatives are actively engaged throughout India to-day in securing orders and advertising their wares. In regard to Japan, it is stated to be difficult to see how any European nation will ever be able to compete with Japanese low-priced labour in those articles where quality is not considered, and where price is the sole desideratum. Apparently we need give only incidental attention to Germany at present if we accept the Commissioner's statement that her whole future is so uncertain that competition need not be anticipated from her for some years, yet it is right to bear in mind that whatever our feelings in the West of Europe may be, "there is not the same intensity of feeling against enemy States in the East as there is among the Allies in Europe." Considering all the circumstances, it is not surprising if this is so, and nobody knows it, and will take advantage of it at the earliest possible moment, more than German traders.

Among the other changes that have developed in Indian commerce during the war, we read of a gradual change of attitude on the part of the old-established conservative, and yet powerful, British merchant houses in Calcutta and Bombay. We are told that they have amassed considerable fortunes without any particular effort, and are consequently now inclined to confine their attentions to the most lucrative and the least troublesome branches of trade. In short, they are more inclined to handle large transactions in jute, tea, cotton, and piece goods than in anything else. Then an effect of the development of Indian manufacturing operations is evident in the statement that large engineering agency firms are now so interested in managing local engineering works that they cannot be expected to pay the same attention to the interests of the home engineering firms that they represent; in certain cases their manufacturing and their distributing interests clash.

It is important to see where this study of the situation leads us. We are assured that our large engineering makers cannot now rely upon securing Indian orders without moving out of London, as in the past. They must take a more active part in the sale of their own goods overseas, open their own branches, and assist local buyers. If a merchant firm be appointed agent for a British manufacturer it is essential that the latter should simultaneously send out a trained representative, well acquainted with every particular of the goods he makes; he must give expert advice to buyers, and must be prepared to travel widely. "The industrial development of India is proceeding on the most modern and scientific lines." The latest and most approved plant is demanded, and managing agent firms "require that assistance and technical advice which only trained engineers and specialists can give."

Mr. Ainscough holds that the time has come when the export merchant in London who has specialised on the Indian market, and holds British agencies, should open his own offices at the principal ports, and set up an active selling organisation throughout India. The manufacturer of machinery, plant, and articles for which there is a large and constant demand, he advises to conduct his own distribution, either singly or in group co-operation. But the Commissioner is emphatic in stating that the India of to-day is a very different place, presenting much more difficult and complex problems, from the India of pre-war times, and that these circumstances will be readily grasped by any British business man who undertakes a visit to the country.

The Wire-Drawing Industries.

The slow recovery towards pre-war percentage of output in the wire manufacturing industries, due in a large measure to labour restrictions, transport congestion, and other such difficulties experienced at the present time by almost every other important section of trade, does not appear to discourage the enterprise of the leading firms, who, it is gratifying to note, are laying the foundations for great expansion of output. There appears to be little doubt that the demand for electrical wires, &c., will increase tremendously in the future; and the large new plants that are now being laid down by several of the leading wire manufacturers appear to be well justified, and should prove a highly profitable enterprise.

NATIONAL ELECTRICITY SUPPLY AND FUEL ECONOMY.

By GEORGE WILKINSON, of Harrogate.

(*Concluded from p. 775.*)

The problems of heat transmission and distribution as practised in America, and to a small extent in Europe in the earlier periods, were not all that could be desired; they have, however, been progressively successful, and they form useful object lessons. With modifications complete success can now be secured from the outset. The first attempts made were by means of exhaust steam from steam power plant, but the low pressures available demanded such large pipes as to be economically prohibitive in capital cost, also much difficulty was encountered, due to condensation troubles. Later installations were using live steam at about 30 lb. pressure, and numbers of imposing stations have been built containing steam heating plants supplying large networks of heat distribution for public purposes. Such stations have been specially designed and built for this sole object with equipments up to 10,000 rated H.P. In Detroit, U.S.A., the district served from central heating stations is 2½ miles long and ½ mile wide, and includes the central business district of the city; the total length of underground steam mains in 1918 was 22 miles, and approximately 1,700 customers were being supplied; the amount of radiation connected at that time aggregated approximately 2,600,000 sq. ft. In the year 1917 a total of 1,769,000,000 lb. of steam was sold. This steam was used principally for heating buildings by means of radiators, but a considerable amount was used for cooking and water heating purposes.

It should be remembered that the closer built and more compact towns in Great Britain furnish a more favourable field for heat distribution than the scattered towns of America, and there is strong probability that once heat distribution was established as a by-product of electric power houses, the problem would be, not how to dispose of the heat generated, but how to find heat enough to meet the demand.

To simplify the problem and increase the efficiency of heat distribution it appears wise to substitute hot water having a sensible outgoing temperature corresponding to a pressure exceeding that necessary to raise the water to the highest point in the distribution network, and in no case less than, say, 240 deg. (10 lb. gauge pressure). It would be mechanically circulated at such a rate that small pipes for distribution would serve, thus decreasing the losses of transmission and greatly decreasing the capital cost. The distribution would be by means of plus and minus mains of equal size, and each service would be taken off the plus or hot water main, the water being returned through the minus or cooler main. Simple and reliable methods are available for holding up the circulation in each building until the temperature of the water at the outlet has dropped to, say, 100 deg. F., when a proportionate amount would be released to the minus or return main, thus each tenement would receive a spasmodic supply, the amount and periodicity thereof depending upon the heating, cooking, and hot water requirements for the time being. The heat distributor medium would thus consist of a closed and continuously circulated body of water. Hot water supplies for manufacturing, washing, and domestic use would be furnished by simple types of calorifiers through which the heat-carrying water would be passed and automatically controlled on the same lines as the radiators. In this way all scale troubles in the exhaust heat calorifiers and the engine jackets in the electric power house would be avoided. The cooler water returned to the power house would first enter the cylinder jackets, and thence pass to the exhaust heat calorifiers, where the final higher temperature would be added. It is interesting to note that some of the best-known British makers of internal combustion engines are quite ready to design engines specially to furnish heated water as a by-product on the lines already described. In localities where there were wash-houses, baths, or textile works in the vicinity of the electric power house, the useful work derived from the fuel consumed could be further increased by furnishing hot water economisers, of which many types are already made. The exhaust gases, after passing through the calorifiers to the emission stack, are still high enough in temperature for this purpose, and in many cases it would be wise to erect baths and wash-houses in connection with the electric supply works. To equalise the variation between supply and demand, hot-water storage would be provided, preferably in tanks in the ground beneath the works, where, if properly designed, the radiation losses would be very small; this reserve would be drawn upon or the storage increased as determined by the relation of supply and demand. To carry over any mishap, shut-down, or the like, oil or gas-fired calorifiers would be provided. It is obvious that in hot weather the heating demand would be greatly diminished, but during this comparatively short period of the year, more consumers would be supplied for heating, cooking, and washing; thus the irksome summer kitchen fire would be abolished from the house. This would tend to level up the summer supply. The levelling process between supply and demand would also be assisted by the fact that the demand for electric supply is less during the summer. In extreme cases the well-known and too frequently-used methods of heat diffusion could be resorted to for getting rid of any temporary superabundance (if any).

The scope of this article does not allow of more detail, but probably sufficient has been said to indicate the general method of usefully employing heat and saving ruinous waste.

Reverting to the question of inadequate size and power of internal-combustion engines, it is obvious that large super-stations, with their super-size generating sets, and their enormously costly extra-high-tension lines, will no longer be required. Progress lies in the development of supply stations adjacent to the actual supply area with units up to, say, 10,000 H.P., and after all a truck load of coal or oil, or an underground pipe line, to such centres is in most cases a better proposition than an extra-high-tension electric supply main, apart from the question of fuel economy.

Internal-combustion engines are already made up to 3,000 or 4,000 H.P., and although simplification of design and increase in power is still needed, there is little doubt that the manufacturers will prove equal to the task when the demand is made evident. The gas turbine for large-sized generators is a proposition which merits more attention. Probably the solution of the problem will be found in the substitution of a pure solidified fuel, containing all the elements of combustion, for the present practice of compressing each gaseous charge in a cylinder before firing.

One of the wisest courses the Government could take would be to appropriate a portion of one of the many millions they are proposing to spend on super-stations for the purpose of setting up a model works equipped with the best internal-combustion plant our experts can evolve, plants being put down both

for oil and gas consumption. Doubtless the Government could have their choice of towns. Any local authority would lend hearty support to such a scheme of cheap electric power and heat supply. Such a model power house would have, amongst others, the following characteristics:—

1. It would be silent in operation.
2. There would be no smoke, smell, or steam vapour.
3. The gas or oil would preferably be transmitted to the power house by a pipe line, thus dispensing with the nuisance of fuel cartage and the removal of cinders and dust.

Demand always stimulates supply, and there is no practical reason why such model works should not be completed in a comparatively short time, and in the meantime development can be met by judiciously extending existing stations, and building additional works of suitable size, where the demand can be met in no other way.

Super-stations demand numbers of sub-stations; let the Government decide to make these sub-stations generating stations instead.

In the Sheffield Report the final conclusion and recommendation reads as follows:—

"In the course of our investigations we have been impressed with the essential importance of fuel economy. In our opinion it is of prime importance that this district should adopt such a general policy and lay-out of plant and mains as will eventually secure the lowest fuel cost. Both from the point of view of the future commercial prosperity of the district, and from that of national coal conservation, it is essential that this aspect of the question should be given full consideration."

With this statement all will agree, but its realisation will not be effected by any system which employs the major portion of the heat of the fuel in raising the temperature of our river and coast waters. Let it rather be employed to fill other equally important requirements which exist in every district where electricity is called for. It is up to the profession, on behalf of posterity, as well as for this present generation, to see that this is achieved.

IF I WERE A SALESMAN (ELECTRICAL, OF COURSE).

By ERNEST C. M. McKINNON, A.M.I.E.E.

Seated at an office desk almost all the year round, one is at times apt to yearn for the salesman's life, with its greater opportunities for mind broadening, maintenance of good health, and social activities.

This feeling may be the natural discontent of human nature, and salesmen are doubtless, on occasion, reduced to moods of depression in which they would gladly exchange their gaudy-coloured string of incidents for the colourless monotone of the office, works, or central station.

It may be the height of presumption to imagine that as a salesman one would prove a shining success, but *experientia docet*, and it is surely a valuable experience to have the advantage, while interviewing an apparently never-ending army of commercial gentlemen, of observing and recording all the admirable traits of the apparently successful salesman, and all those little points where the unhappy class of the mediocre just fail to favourably impress.

The following impressions formed by the writer may be of interest, even if somewhat chimerical.

The successful salesman should be a specialist in his particular branch, and this implies a thorough practical training and a sound theoretical education.

Qualified engineers should be sent to interview engineers. Let them be accompanied, when necessary, by a salesman who can discuss prices, but the man who is strong on figures, but weak on technical points, is terribly handicapped, and his firm suffers accordingly.

The successful salesman should have a good address—no ostentatious display of jewellery and "loud" clothes, but well groomed and barbered, clean linen, neat quiet clothes and smart shoes, all harmonising to give such a distinctive air of prosperity, that the parties interviewed mentally label him "lucky fellow," instead of "poor devil."

This asset is so important that the writer suggests in all sincerity that companies should allocate a fixed sum per annum—and insist on its being expended—to the clothing account of their sales representatives, charging this, very reasonably, to the advertising account.

Organisation is an admirable asset for the successful salesman. This may be divided into several headings, of which the following are only a few:—

(*a*) *Getting Hold of the Right Man.*—What is the sense of wasting time and eloquence trying to impress an assistant when competitors gain interviews with the man who has the placing of orders?

(*b*) *Calling at Suitable Hours.*—These naturally should be suitable to the *purchaser*. One hour for the morning mail, one for luncheon, and one for signing letters, &c., still leave several hours during which the salesman is less unwelcome. The office hours, meal hours, and early-closing days (if any) of the various firms should be docketed.

(*c*) *Recording all Essential Details.*—A salesman's memory should be carefully trained, or he should take very complete notes.

(*d*) *Catalogues.*—He should keep his company advised as soon as ever its catalogues show signs of obsolescence to a degree causing comment by the customers. An up-to-date catalogue is one of the salesman's best weapons. A catalogue plastered with insets, errata slips, notifications of advances and reductions (rare) in prices is an abomination and a snare. He should, therefore, educate his company to the customers' requirements. Let him suggest, recommend, beg, urge, request, demand, and insist in turn until he has the necessary up-to-date catalogues, with the actual articles described and priced which he has to sell. If all his efforts are in vain, he has at least the satisfaction of knowing he has done his best, and he can either follow the example of Cabinet Ministers, who, when they cannot have matters all their own way, resign, or he must do what presumably most of his British *confrères* have to do—be resigned.

Shop-soiled catalogues are best sent through the post, so that the postal authorities may be unjustifiably blamed for their tired appearance. If the salesman prefers to be able to produce something from his official looking attaché-case, the catalogues should be kept in a different compartment to that used for railway refreshments. A squashed currant, or stains of butter and ham fat, detract from the freshness of the catalogue.

Vices are acquired by opportunity, but virtues may be inherent, and should be developed by the would-be successful salesman. A suitable selection from the following would always be useful stock-in-trade:—

Optimism.—The successful salesman should appear invariably cheerful. We—the long-suffering interviewed—do not want our dulness deepened by the domestic troubles of the salesman, the wickedness of competitors, or the short-sighted failings of his employers.

Patience.—No one should let his angry passions rise while waiting on the mat for the convenience of the busy man, or the resulting scowl may "get his back up." There must be profitable ways of spending the time. The commissionaire's goodwill is frequently worth cultivating, and a little attention given to the lady typist usually reaps its own reward.

Persistence without Aggression.—As an example, it

should not suffice to be put off with put-offs such as "Nothing to-day," or "Mr. —— is engaged," or "We will let you know when there is anything"; nor is it really something attempted, something done, just to drop a business card through the letter slot if the call has a time lag to the office hours.

Thoroughness and Reliability.—A chance should never be given for a bargain to be upset through misunderstandings on the part of the salesman. If a customer writes to a firm *re* a quotation or order, "I was given to understand very clearly by your Mr. X," and the firm, very reluctantly, has to contradict Mr. X, the customer's confidence in the salesman is weakened.

Genuineness.—This borders on, but is hardly the same, as the above attribute. There is always a feeling of reserve when dealing with a man who has the reputation of not being genuine, who is lavish with promises, with no real intention of carrying them out. Promises made must be kept.

Attentiveness to Customers.—It is very desirable that the salesman should act as a buffer between the customer and the contractor. He should carefully prevent formation of the impression that his interest slackens off after orders have been placed.

He should not encourage prospective customers to imagine that their credit will be unchallenged. It is bad for future relations if a salesman takes orders which are turned down at headquarters on the question of credit. How much better if the salesman be empowered to deal, under clearly defined limitations, with terms of payment which he can settle with the customer at the placing of the order.

Affability and Sympathy.—These carry a salesman far. One good turn deserves another. It does not cost much to be obliging. Friendly hints of business to be obtained, and of openings for juniors, encourage good fellowship.

The commissionaire at a large central station tells how the boot-repairing bill of his family has been greatly reduced by a hint given him by a sales engineer, while waiting his turn. A little act in itself, but that engineer now always knows when to catch his man, without having to wait.

Candour.—The salesman should keep his employers fully posted about the difficulties he has to encounter. It is inconceivable that a salesman can "make good" with every firm he calls on. It then rests with headquarters to decide if a special envoy should be sent to the recalcitrant parties.

Tact.—However welcome a salesman may be on arrival, it is tactless to outstay that welcome. Having concluded any business and sociabilities, the interview should cease, and time-tables can be consulted outside. This is far preferable to suddenly discovering that there is no train for 45 minutes, and sitting down again, thereby probably wasting the time and wearing out the patience of a business friend.

Provincial salesmen should remember when privileged to "work" London that they may have to deal with supercilious, if not super-men.

London sales gentlemen favouring the provinces with their enlightened presence should be compassionate to those whom they may inwardly disdain.

They should also bear in mind that reports about the splendour of the Marble Palace on the Embankment do *not* constitute news from home to country members, but are more likely to scarify a barely-healed sore.

Playing the Game.—Insinuations and innuendos about competitors are bad form, and are difficult to combat, if in time inducements lead to the salesman travelling for one of the maligned competitors.

The annual distribution of tobacco, which, the writer understands, is still practised by a few firms (!), savours of insidious bribery, or blackmail.

Versatility.—The one-theme artist proves wearisome, whether it is on the weather or inquiries for the family's health. Surely there can be something fresh and real to talk about, and so rouse the interest of the bored. "Props" do vitalise, but it is only an evanescent popularity which is merely achieved by the promiscuous distribution of diaries, match-boxes, paper-weights, and letter-openers.

Imperturbability.—The salesman should be ready to stand chaff, but not submit to bullying.

The tale is told of a man who called on a blustering prospective customer, and was received with a gruff "Well! Who the b—— h—— do you represent?"

His ready reply, presenting his firm's card, "These b—— fools!" is said to have formed the foundation for satisfactory business relations.

Self-Confidence.—A little bounce is harmless, and is a good substitute for the skips of Home-trade commercials.

If the salesman's value of his own ability is not overestimated, and he has good wares to sell, what is there to be downhearted about? *Crafty* competitors? Surely not!

Let him build up a connection by his own personal efforts and merits, without groping for influence and inflated sales by the aid of secret signs and ju-juic hand shaking. Let him grip his duties, grasp his opportunities, and be square to *all* men, and he need have no fear of being squeezed out by hidden influences.

Moderation.—The salesman should be clear and concise in his explanations, and talk in reason. He should not aspire to the dubious rank of High Priest of Hot Air.

Verbosity is confusing and irritating. Manners mark a man, mannerisms mar him. Moustache curling, head scratching, finger nail inspection, the nose tapping of the hyphenated Teutonic traveller, and the imaginary harp-twanging of the Jewish gentleman, are distracting mannerisms.

Expressions such as "do you see," "don't you know," "as it were," and "my dear Sir," repeatedly interposed in explanations and arguments, are as irritating as they are unnecessary.

He should avoid being too scientific. There is a sound moral to be deduced from the instance of a certain canvasser who was endeavouring to convince an old butcher of the advantages of electric lighting. "Well!" said the butcher, "I don't know anything about these 'ere units that you keep talking about, but 4d. sounds a lot for one of 'em!"

The successful salesman should be a polished raconteur, and even if he has no sample goods, his stock of stories should extend over the whole prismatic scale.

A man accustomed to strong meat wearies quickly of slops. For this reason it is very useful to ascertain (indirectly, of course) the nationality, religious belief, and week-end pursuits of the various "men to see." He should never go too high on the scale with heads of firms in the presence of their subordinates. Business dignity must be maintained.

If in doubt, however, about Corporation officials and chief engineers in general, it is fairly safe to veer towards the violet, unless they are known to be Primitive Methodists or Presbyterians.

He should endeavour to give new anecdotes every round. This should not be difficult, as the stock available appears inexhaustible; but caution is necessary.

If he tells a Welshman the same story on two consecutive rounds, it is a *faux pas*. In the interim it has become his own story, and if he brings it out first it is etiquette for the salesman to raise a smile, and swallow in silence the discomfiture of one of his best being thus ruthlessly filched.

Another useful hint is given in the strictest confidence. We Scotchmen rarely see the joke in a clever story at the first time of telling, and after it has been explained to us, we like the story to be repeated, so that this time we can laugh at the right point.

An excellent, if slightly *risqué*, little story, illustrating this, is the following:—

(Deleted. The author went right off *our* prismatic scale.—Ed.)

The successful salesman should be a "sport."

His ability should not be gauged by his capacity for beer, nor the strength of his arguments by his tobacco consumption. If, however, he is willing to participate in innocent amusements, and is able to excel in manly sports, his popularity is assured. For him all doors are open with the welcome "Hullo! Here's good old ——!" instead of that repelling "Oh! Dash! Here's that old ——! Tell him I'm out!" duly conveyed to the unhappy wanderer on the mat.

The salesman should try to cultivate a bold literary style. Drafts of his suggested reports to prospective

customers will then probably be used *in extenso*, and he is thereby assured that his conclusions and arguments are not mangled beyond recognition in the official report.

It is a moot point whether the salesman should be a poet. True, he can thereby beat the big drum, or, perchance, attain a one day's prominence in electrical circles, on the drum of a popular calendar, but poets are notoriously bad company, and besides, he is entering into competition with central station and other engineers, whose efforts may thus be crowded out, so much so that the writer ventures to conclude this article by smuggling in one of his own efforts in the hope that the Editor won't notice it. [But he *did* notice it.—Editor.]

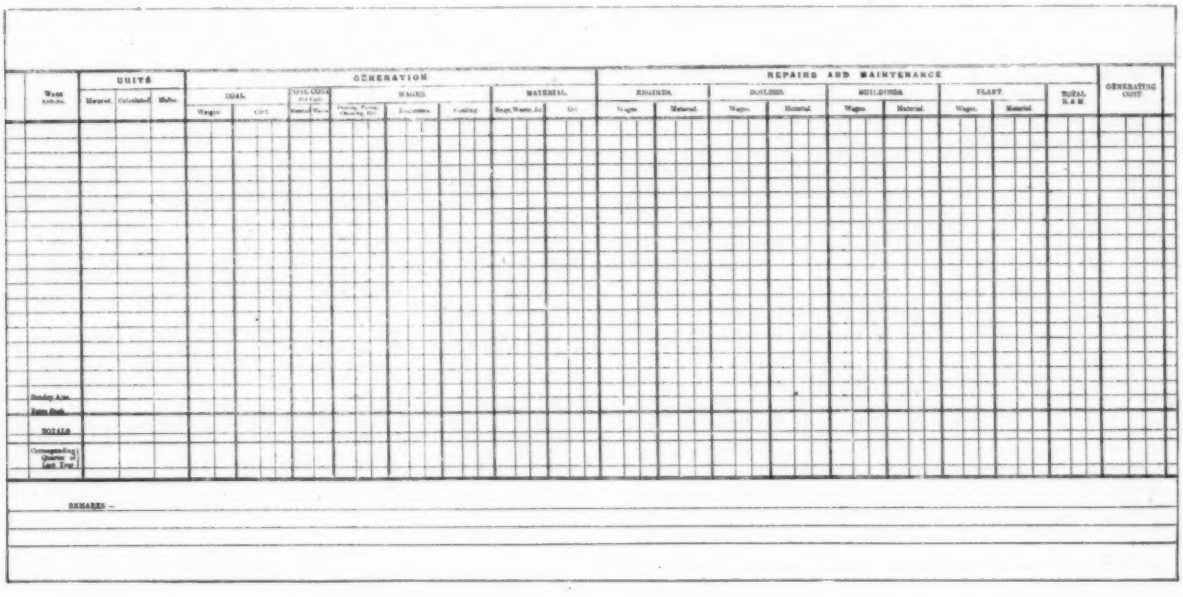
A WEEKLY WORKS COST BOOK.

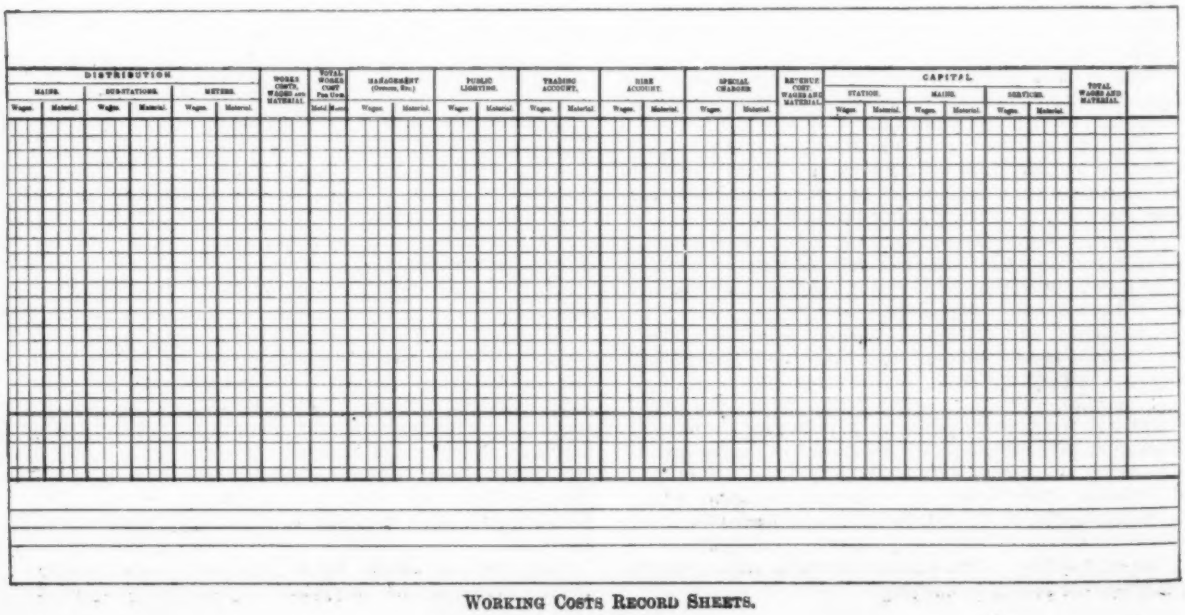
By "INTERESTED."

Now that the great war is nearly over, one wonders if our troubles ever will be in a similar happy state. Certainly those in charge of electricity supply undertakings wonder if coal is ever really going to cheapen, or if industrial conditions will eventually allow of some reduction in the rates of pay for labour. How now that oft-repeated cry of cheap electricity for the masses at ½d. per unit? Increased charges for energy supplied are one way of somewhat mitigating the worry, but such advances sometimes reflect economy on the quarterly accounts.

The major portion of what may be termed the temporary war load disappeared at or soon after the termination of hostilities; and idle plant is bad for business, whatever excuses are provided. Necessity demands increased sales of electricity, and the prudent company or local authority will not advance its rates for supply higher than necessary, after careful survey of its position and future prospects. Under any conditions the value can hardly be exaggerated of watching very carefully properly recorded statements of actual costs week by week. The chief is thereby able to prune immediately where necessary, without waiting until the accounts advertise that something heavy requires removal.

The book here illustrated presents working costs week by week, both wages and material, and provides in detail the expenditure at a glance each week end, and by its completeness enables a real hold to be taken of all money spent. Excepting such items as legal, interest, and sinking fund, &c., the figures are as near complete as it is possible to provide in





WORKING COSTS RECORD SHEETS.

a weekly form. Space is provided for each month to be totalled independently of the quarterly figures. Such items as petty cash and sundry accounts for work done are only added quarterly, as will be seen from the illustration. The bottom space is reserved for the figures of the corresponding quarter of the previous year for purposes of comparison.

THE ENTZ ELECTRIC TRANSMISSION SYSTEM IN THE OWEN MAGNETIC CAR.

By F. H. HUTTON.
(Author of "Electricity and the Motor Car.")

In the Electrical Review dated November 7th last appeared the following passage: "Under the heading of a 'Mysterious Motor Car' the *Daily Mail* recently published an article concerning an electro-magnetic clutch. It appears that the contributor is investigating automobile matters in the U.S.A.; in New York he was taken for a ride in a machine fitted with an electro-magnetic clutch and a separately driven dynamo-battery set probably for excitation. The feats accomplished during the drive are described as including the climbing of a steep hill, standing thereon without the application of the brakes, rapid acceleration and retardation, absolute freedom from skidding, noiseless running, creeping speed, &c., &c., &c., certainly a remarkable performance, but it is difficult to extract anything definite from such a journalistic effort as that before us. The most definite part of the story as published seems to be the following: 'One engine to whose flywheel is attached one large magnet. Within the poles of this magnet is an armature which is attached to the propeller shaft. There is a second armature and a small battery. There is neither clutch nor gear box. The first armature does not touch the magnet. Nothing but air joins the engine to the back axle.' Electro-magnetic clutches are not new, but if there is anything really new about this American device we should like to hear more about it."

As you truly remark, it is difficult to extract much definite information from such flights of journalism as quoted from the *Daily Mail*, but by the exercise of a little imagination it would seem that the car referred to is none other than the Owen Magnetic. This most interesting development of electric transmission is not exactly new, the Owen Magnetic car having been running in America for some years, and being an outcome of the former Germain system. The Owen Magnetic is euphemistically described by its makers as "the car of a thousand speeds," and while making due allowance for natural enthusiasm on their part, it must be admitted that the principle is extremely interesting, and is a step along the path of progress in the way of substituting the refined methods of electric transmission in motor cars for the "brutal" though effective system of sliding mechanical gears. The system actually employed in the Owen car is that known as the Entz, and, briefly, consists of two electrical units, one occupying the usual position of the fly-wheel which for convenience is called the generator, and the other one further aft, placed in the usual location of the gear box, which we will call the motor. There is also a small battery for lighting and starting purposes. The field magnets of the generator revolve with the engine, and, in fact, act as a fly-wheel; the armature is attached positively to the propeller shaft. The field magnets of the motor are stationary, being fixed to the frame of the car, but the armature is, like the dynamo armature, connected to the propeller shaft. In any case, therefore, the two armatures run at propeller shaft speed while the dynamo field magnets run at engine speed and the motor field is fixed.

Consider first the action of the transmission on what corresponds to high speed gear, *i.e.*, the normal running position. The motor, considered as part of the transmission, is then out of action, all its duties being then confined to generating a small current for battery charging by means of a special shunt winding provided for the purpose. The generator, however, is, during this time, acting as a magnetic clutch generating its own power by means of a slight difference in speed between the rotating field and the armature. For example, these speeds may be 1,060 and 1,000 respectively, the difference of 60 R.P.M. between the relative speeds being sufficient to generate enough power to cause the magnetic grip between the two. If a slight gradient is met with, the slip between field and armature increases slightly, which in turn generates more current and strengthens the grip. In this normal running position, therefore, there is no mechanical connection between engine and road wheels, all the power being transmitted through the magnetic clutch, which generates its own power, through the slight amount of slip which is always taking place, more or less, according to the road resistance encountered.

Now go to the other extreme and consider the action on what corresponds to the lowest gear. In this position a large amount of slip takes place, that is, the engine with the field magnets continues to run at its speed giving maximum power, while the armature, being attached to the propeller shaft, is much retarded. A large current is, therefore, generated, which, in addition to causing the magnetic grip of the clutch, is also switched on to the motor unit, and is there employed to help in turning the propeller shaft. The more slipping takes place between field and armature of the generator the more current goes to the motor to increase the torque on the shaft. We have now considered what takes place on high and low gear respectively. Intermediate positions are obtained by switching more resistance gradually into the motor circuit, which has the effect of increasing the grip of the clutch, and so tending to make the propeller shaft run nearer to engine speed. Five positions are provided for intermediate speeds in this manner. For starting, current from the battery is switched on to the generator, causing the generator to "motor" and start the engine.

Another position of the regulating switch provides for a boosting charge being taken from the generator to charge up the battery if this has become unduly low; it is only intended for emergencies, as the battery is normally kept charged from the "motor" unit in the high gear running position as previously explained.

Another feature of the transmission is that it provides an electric brake which will keep the speed of the car down to 15 or 20 miles an hour on any gradient automatically, in the following manner. If the controlling lever is put into neutral position while the car is running on top gear, then the heavy current generated by the series windings of the motor is switched into a resistance, and so produces the braking action, which varies as the speed of the car. A smooth acting and silent brake is thus provided without any mechanical wear. In another way an electric brake is provided which can be used to hold the car from running backwards on any gradient without the use of mechanical brakes, for by putting the control lever in the position where maximum clutch slip is allowed and running the engine slowly, a balance can be obtained between the power of the engine and the force of gravity on the car which will just prevent the car from running backwards. This is undoubtedly the feature referred

to by the *Daily Mail* journalist in his fanciful account.

The following extracts from an article in the *Automobile* on the Entz transmission are interesting:—

"Perhaps it might be said that the magnetic transmission is to the chassis what the pneumatic tire is to the wheel. It does not add so much to the comfort of motoring as does the pneumatic tire compared with a steel tire, but the utter absence of all sense of hardness is very similar to that given by the pneumatic tire. . . .

"The car handles more as though it had only one speed. There is a throttle pedal which operates normally, and above the steering wheel is a lever very much like the usual throttle lever. If opening up on the accelerator pedal is not enough to meet the road conditions of traffic or gradient, then the lever is pushed along an inch or two, and the car gathers way just as though a second gas feed had been put into commission or a few more cylinders added to the motor. . . .

"The principle of operation is really that of the clutch. The Entz transmission is an electro-magnetic clutch which is always slipping, sometimes a great deal, sometimes very little; and the energy dissipated by the slip is caught to be used up again later on. . . .

"There is no mystery about the action of the transmission whatever. What cannot be put into words is the really remarkable difference between driving a car with this transmission and an ordinary car. One most curious effect is that if the foot is taken off the accelerator pedal the effect is equivalent to releasing the clutch of an ordinary car. The engine is totally disconnected as soon as the magnetic grip lets go, and this it practically does as soon as it gets down to idling speed. . . .

"While ordinary hills can be taken without touching the control, the wide range of speeds allows a very rapid acceleration up hill if starting on the grade, because the engine can be allowed to run up to 1,000 revolutions or so, and then the control lever pushed slowly forward. As step by step it passes, the engine speed holds more or less constant at its power peak position, and the car gathers speed."

A NEW ELECTRIC WINDING ENGINE.

A NEW winding plant of a modern type, which, though not claimed to be original, is unique in the county of Northumberland, was recently put to work at the Cowpen Coal Co.'s Isabella colliery. The winding engine is operated and controlled on the Ward-Leonard system, the electrical energy being supplied by the Northern Counties Electricity Supply Co., Ltd., being 3-phase, 40 cycles per second, and at a pressure of 2,750 volts between phases. The engine is required to raise ultimately 150 tons per hour, and at present 120 tons per hour from a vertical depth of 900 ft., the weight of the cages and ropes being balanced. There is one decking level, and decking is done without the assistance of mechanical appliances.

The winding plant is fitted with a cylindrical drum 10 ft. in diameter, of sufficient width to accommodate the necessary 4.5-in. circumference winding ropes. The brakes are of the post type disposed one on either side of the drum. Both brakes are applied by means of weights, and are held off the brake rims by a compressed air brake-engine operating at 50 lb. per sq. in. air pressure, the air being supplied either from a self-contained, electrically-driven compressor forming part of the plant or from the main pit supply.

A vertical depth indicator is attached fitted with two pointers and a warning gong, driven by means of machine-cut gearing and arranged for automatically retarding and stopping the winding motor in case of overwind. Other electrical and mechanical safety appliances achieve such results as: (1) Stopping the winding motor and applying the brakes in case of failure of supply to the converter set. (2) Stopping the winding motor and applying the brakes in case of failure of exciting current, or should the air pressure fall below 50 lb. per sq. in. (3) Making it practically impossible for the driver to raise the cage higher than a pre-determined distance above the keps, which in this instance is 3 ft. As a further protection against overwinding, end-limit switch gear is fixed in the head gear which contacts with the cage, releases an emergency brake, and stops the engine in the remote event of the cage travelling beyond the 3 ft. mark.

The Ward-Leonard set is of the 3-bearing type, the present motor being constructed for an output of 445 KW. when running at a speed of 590 R.P.M.; the bedplate is designed to accommodate the permanent driving motor which will be wound for a speed of 800 R.P.M., and give an output of 550 KW. The winding motor is of the direct-current, open ventilated type, and is fed direct by the Ward-Leonard variable-voltage dynamo. The speed with full pressure applied to its terminals under present conditions is 53 R.P.M. for an output of 120 tons per hour, the ultimate speed being 70 R.P.M. for an output of 150 tons per hour. A Kapp phase compensator of Messrs. Sandycrofts' make works in conjunction with the motor and the Ward-Leonard set.

The control gear includes a controller for the field of the Ward-Leonard dynamo with about 150 steps, combining an arrangement for automatically reducing the field of the winding motor to 25 per cent. of full when the engine is standing, and also an emergency switch for breaking the field of the W. L. dynamo. A direct-current brake magnet for working the trip gear on the emergency brake, as well as a maximum relay to actuate the brake magnet should the armature current exceed a maximum, together with a minimum cut-out in series with the field of the winding motor, is provided. The driver's control frame is suitably placed, and fitted with all the necessary levers capable of easy manipulation. A recording tachograph, speed indicator, ammeter, and voltmeter are fixed in full view of the driver.

The erection was completed in August, 1914, but owing to war conditions it was deemed inexpedient to commission the plant until about the middle of November of the present year. The steel pulley framing and structural work, as well as the housing and foundations, were all carried out to the plans and designs of the coal company's engineering staff. This electric winding engine is working in every way satisfactorily, and supplants a vertical condensing steam winder, which has done good service for a period of 70 years.

We are indebted to Mr. C. Hunter, chief engineer, for supplying the details set out above.

A SYSTEM FOR THE RECEPTION OF CONTINUOUS WAVES.

By Lieut. JOHN SCOTT-TAGGART, M.C.

(*Paper read before the* WIRELESS SOCIETY OF LONDON. *Abridged.*)

THE arrangement to be described is of interest largely because it solves in one way the problem of producing a continuous-wave wireless receiving circuit capable of "stand-by" and "tuned" adjustment combining ease of manipulation and high selectivity. In addition, the circuits may be adjusted so as to reduce radiation to a negligible value. The complete arrangement was designed by the author and used for certain special artillery communications during the fighting of 1917 and 1918. As evidenced by reports, it proved of exceptional value in battle, and overcame the difficulty, previously experienced, of interference by neighbouring "spark" stations. On several occasions communication was steadily maintained with a forward station 15 km. away, although a 2-KW. spark set was operating within 300 yards of the continuous-wave receiving station and working on a wave-length only slightly different.

The arrangement may be divided into three essential circuits A, B, and C, fig. 1. The circuit B is of the usual type. An aperiodic retroactor coil L_2 is coupled to a variable inductance L_1; this coupling is made variable, and if sufficiently tight will cause the circuit B to oscillate of its own accord at a frequency determined chiefly by the value of the condenser C_1. The filament of the vacuum tube V_1 is heated by a six-volt accumulator B_1 through a rheostat R_1 of about five ohms resistance. A plate battery H_1 of about 60 volts and the primary T_1 of a step-up transformer T_1 T_2 are connected as shown, a fixed condenser C_2, of about 0.006 mfd. being connected across H_1, and T_1 in order to by-pass the high-frequency component of the plate current of V_1.

The portion A is exactly the same as B except that no aerial or earth connection is made. The filament of V_2 is heated by current from the common accumulator B_1. A double change-over switch S enables any low-frequency current supplied by T_1 or T_2 to be applied to an audio-frequency or note amplifier C. This circuit C possesses an inter-valve step-up transformer T_3 T_4, a telephone step-down transformer TS TS, a pair of low-resistance telephones T, a plate battery H_2 of 60 volts, a filament-heating accumulator B_2, and other features which will be understood by reference to the figure.

The circuit A is placed near the circuit B so that an inductive effect is obtained. The distance between A and B should preferably be variable, and for eliminating interference the author has placed A as much as six feet away from B, although one to two feet is more usual.

While "listening-in," the switch S is placed over to the right, and all reception is accomplished by means of the B circuit. The coupling between L_2 and L_1 is adjusted until the circuits commence to oscillate of their own accord. By adjust-

ing C_1 the tuning of the aerial circuit and the adjustment of the local frequency are accomplished simultaneously, and signals from an external C.W. transmitting station are easily picked up. It is to be noted that signals will only be heard if the local frequency is either greater or less than the incoming frequency by between 100 and 4,000. Beyond these limits the beats produced will, for all practical purposes, be inaudible. By gradually increasing the capacity of C_1 continuous-wave signals are first heard in T as a high note, which will gradually decrease as the capacity of C_1 is increased. A silent point will ultimately be reached, and under these conditions the local frequency will equal the incoming frequency. The aerial circuit will now be exactly tuned to the incoming frequency. As the value of C_1 is increased still further, beats will once more be formed, and a note will be heard which will gradually increase in pitch as the capacity of C_1 is increased, until it passes the audible-limit.

The signal strength obtained on this circuit B will depend to a certain extent on the value of the coupling between L_2 and L_3, the plate voltage, and the filament current. The cumulative method of grid rectification is employed, a grid condenser C_2 of about 0.0003 mfd. being shunted by a resistance R_1 of about 3 megohms. Apart from the correct choice of a suitable operating point on the grid and plate current curves, we are also concerned with the correct adjustment of the amplitude of the local heterodyning oscillations. This adjustment cannot conveniently be made, a disadvantage which is keenly felt.

It will be seen that for a beat note to be produced, the aerial circuit must be slightly mistuned, in order to produce local oscillation of a frequency differing from the incoming frequency. The incoming waves force themselves into the aerial circuit in spite of the fact that the latter is out of resonance. While preserving their original frequency the oscillations have their amplitude decreased, and cause a loss in signal strength which is very noticeable in the case of weak signals. The higher beat notes correspond to greater disparities between the local and incoming frequencies. Consequently, a high beat note necessitates a very considerable mistuning of the aerial circuit, especially in the case of wavelengths higher than about 500 metres. This fact explains why the loudest signals are invariably obtained on almost the lowest beat notes, since under these conditions the loss of efficiency due to mistuning is at a minimum. If this secondary effect were absent, the loudest beat notes would, in the case of an average pair of telephones, have a frequency in the neighbourhood of 1,000.

The advantage of rapid adjustment while making the arrangement suitable for "picking-up" signals renders it open to serious interference from spark stations. Another very important disadvantage is that the circuit radiates while receiving. The B circuit acts, in effect, as a small power transmitter which will cause incalculable interference with other continuous-wave receiving stations within a few miles radius. It is safe to say that in nine cases out of ten, the local oscillations are far stronger than necessary. Unfortunately, attempts to decrease the oscillating energy usually result in stopping the circuits oscillating or impairing the detector efficiency of the circuit.

The disadvantage of excessive jamming may very largely be overcome by tuning the oscillating B circuit to the silent point of signals, decreasing the coupling between L_2 and L_1, or decreasing the filament current of V_1, so as to prevent V_1 from oscillating, and then switching S over to the left and retuning on the circuit A, which is made to oscillate. The complete arrangement now acts as if an aerial circuit were very loosely coupled to the oscillatory circuit L_2 C_4. The filament or plate voltage of V_1 may be dispensed with, and signals will still be heard if the circuit A is tuned to oscillate at a frequency slightly different to the incoming frequency. Owing to the very loose coupling between L_1 and L_2 spark signals suffer in amplitude to a much greater extent than continuous-wave signals which persist. Another advantage of the arrangement is that the energy radiated from the aerial is merely that induced by the circuit A, which is a negligible amount if the distance between A and B is considerable. The chief disadvantage of the arrangement lies in the fact that considerable inefficiency is caused by the impedance of the mistuned circuit L_2 C_4.

A further development which leads to much louder signals is to adjust the B circuit to the pre-oscillatory or subgenerative condition immediately preceding self-oscillation, by increasing the coupling of the retroactor coil L_2 or the magnitude of the filament current, of which the latter adjustment is preferable. The incoming continuous waves are now retroactively amplified, a phenomenon which has received scant attention as applied to continuous waves. Through the retroactive effect, which partakes of the nature of a negative resistance, the energy losses are decreased, and the amplitude of incoming signals increases, much louder results being obtained in the telephones T.

The ratio between the amplitudes of local and incoming oscillations is of great importance, and its effect will be very

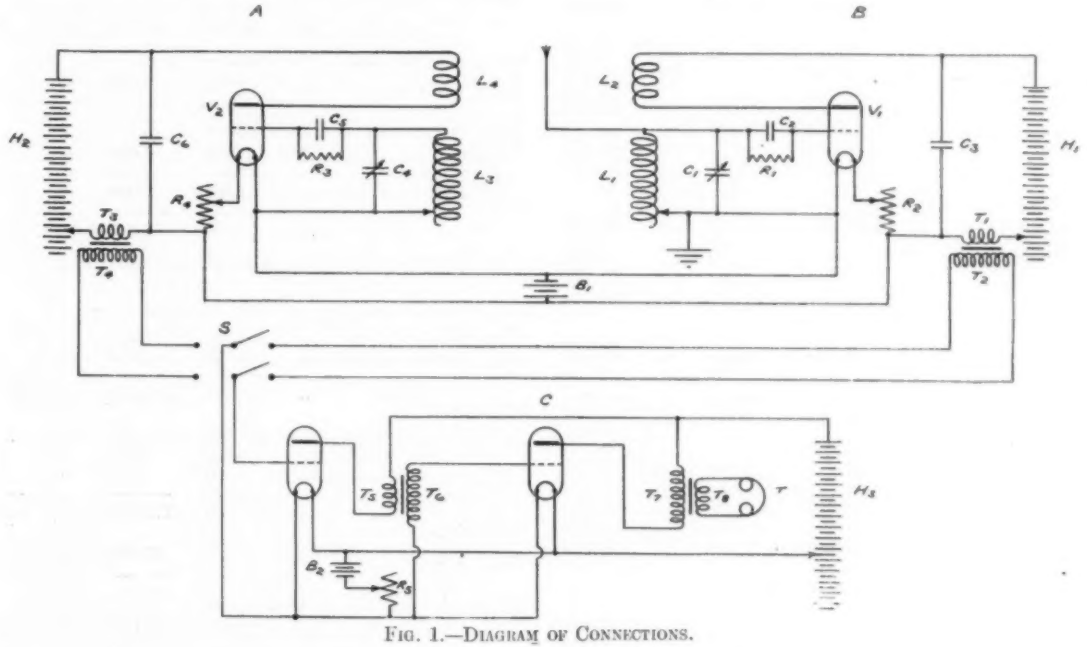


Fig. 1.—Diagram of Connections.

noticeable on the circuit under discussion, which allows for considerable variations of the ratio.

Let us suppose that the amplitude of the local oscillations is L and that of the incoming signals is I. We will readily see that the amplitude of the beats will vary from a maximum of L+I to a minimum of the difference between L and I. Suppose that L is greater than I. Then the average beat current, when rectified, will be proportional to

$$[(L+I)-(L-I)]/2=I.$$

Consequently, we can say that when the local current is greater than the incoming current the signal strength will be proportional to the amplitude of the incoming signals. A near-by continuous-wave station would consequently drown a distant station. If, however, the amplitude of the local oscillations is made less than that of the incoming waves, the beat amplitude will vary from L+I to I−L. The average rectified current would therefore be

$$[(L+I)-(I-L)]/2=L.$$

In other words, unless the local oscillations are weaker than the incoming signals, the signal strength is proportional to the amplitude of the local current. Consequently, a very-high-power station would not give any louder signals than a weak distant station. This effect is decidedly useful sometimes to prevent excessive interference.

These theoretical observations are fully borne out in practice, and many interesting facts may be deduced from circuits of the type described here. To determine the frequency at which circuits A or B may be oscillating, it is useful to use one of the various types of hetrodyning wavemeters which have been devised.

E

TRADE STATISTICS OF INDIA.

The following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1918, are taken from the recently-issued official trade statistics; details for the year ended March 31st, 1913-4, being the last normal year of trade, are added for purposes of comparison, and notes of any increases or decreases are given :—

The 1916-17 figures were published on p. 143 of our issue of August 9th, 1918.

	1913-4 £	1917-8 £	Inc. or Dec. £
Brass, wrought.—			
From Great Britain ...	49,000	24,000	– 25,000
,, Japan	1,000	249,000	+ 248,000
,, Straits Settlements	5,000	11,000	+ 6,000
,, Other countries ...	54,000	25,000	– 29,000
Total ...	109,000	309,000	+ 200,000
Copper, wrought and unwrought (excluding ore).—			
From Great Britain ...	667,000	33,000	– 634,000
,, Germany	193,000	—	– 193,000
,, Belgium	57,000	—	– 57,000
,, France	170,000	8,000	– 162,000
,, United States ...	—	17,000	+ 17,000
,, Japan	274,000	351,000	+ 77,000
,, Other countries ...	13,000	21,000	+ 8,000
Total ...	1,374,000	430,000	– 944,000
Iron wire.—			
From Great Britain ...	74,000	29,000	– 45,000
,, Germany	38,000	—	– 38,000
,, Belgium	15,000	—	– 15,000
,, United States ...	22,000	221,000	+ 199,000
,, Other countries ...	11,000	93,000	+ 82,000
Total ...	160,000	343,000	+ 183,000
Prime movers, other than locomotives.—			
From Great Britain ...	512,000	110,000	– 402,000
,, United States ...	7,000	45,000	+ 38,000
,, Other countries ...	25,000	16,000	– 9,000
Total ...	544,000	171,000	– 373,000
Electrical generators.—			
From Great Britain ...	20,000	4,000	– 16,000
,, Other countries ..	1,000	1,000	—
Total ...	21,000	5,000	– 16,000
Electrical motors.—			
From Great Britain ...	83,000	28,000	– 55,000
,, United States ...	3,000	18,000	+ 15,000
,, Other countries ...	7,000	1,000	– 6,000
Total ...	93,000	47,000	– 46,000
Machinery, other (except textile, agricultural, and printing).—			
From Great Britain ...	753,000	235,000	– 518,000
,, Japan	3,000	41,000	+ 38,000
,, Italy	1,000	5,000	+ 4,000
,, United States ...	35,000	244,000	+ 209,000
,, Other countries ...	95,000	30,000	– 65,000
Total ...	887,000	555,000	– 332,000
Other electrical machinery.—			
From Great Britain ...	195,000	92,000	– 103,000
,, Italy	2,000	8,000	+ 6,000
,, United States ...	2,000	37,000	+ 35,000
,, Other countries ...	33,000	4,000	– 29,000
Total ...	232,000	141,000	– 91,000
Electric lamps and parts.—			
From Great Britain ...	42,000	46,000	+ 4,000
,, Holland	1,000	40,000	+ 39,000
,, Japan	1,000	29,000	+ 28,000
,, United States ...	1,000	10,000	+ 9,000
,, Germany	9,000	—	– 9,000
,, Hungary	6,000	—	– 6,000
,, Other countries ...	1,000	2,000	+ 1,000
Total ...	61,000	127,000	+ 66,000
Electric wires and cables.—			
From Great Britain ...	144,000	42,000	– 102,000
,, Italy	1,000	3,000	+ 2,000
,, Japan	—	167,000	+ 167,000
,, United States ...	3,000	4,000	+ 1,000
,, Other countries ...	10,000	1,000	– 9,000
Total ...	158,000	217,000	+ 59,000
Mining machinery.—			
From Great Britain ...	64,000	17,000	– 47,000
,, United States ...	29,000	15,000	– 14,000
,, Other countries ...	3,000	4,000	+ 1,000
Total ...	96,000	36,000	– 60,000
Electric fans.—			
From Great Britain ...	32,000	13,000	– 19,000
,, Italy	16,000	49,000	+ 33,000
,, United States ...	23,000	75,000	+ 52,000
,, Other countries ...	11,000	4,000	– 7,000
Total ...	82,000	141,000	+ 59,000
Other electrical instruments, apparatus, &c. (except telegraph and telephone materials).—			
From Great Britain ...	327,000	153,000	– 174,000
,, Holland	—	14,000	+ 14,000
,, Japan	2,000	81,000	+ 79,000
,, United States ...	52,000	44,000	– 8,000
,, Other countries ...	34,000	9,000	– 25,000
Total ...	415,000	301,000	– 114,000
Scientific, &c., instruments.—			
From Great Britain ...	82,000	51,000	– 31,000
,, France	—	3,000	+ 3,000
,, United States ...	2,000	35,000	+ 33,000
,, Other countries ...	8,000	10,000	+ 2,000
Total ...	92,000	99,000	+ 7,000
Telegraph construction materials.—			
From Great Britain ...	7,000	6,000	– 1,000
Telephone construction materials.—			
From Great Britain ...	22,000	6,000	– 16,000
,, Sweden	—	5,000	+ 5,000
,, Other countries ...	1,000	2,000	+ 1,000
Total ...	23,000	13,000	– 10,000

In addition to the foregoing, the following were imported as Government stores :—

Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	132,000	321,000	+ 189,000
,, Other countries ...	2,000	3,000	+ 1,000
Total ...	134,000	324,000	+ 190,000
Machinery.—			
From Great Britain ...	201,000	172,000	– 29,000
,, United States ...	1,000	4,000	+ 3,000
,, Other countries ...	2,000	1,000	– 1,000
Total ...	204,000	177,000	– 27,000
Iron wire.—			
From Great Britain ...	12,000	62,000	+ 50,000
Telegraph construction materials.—			
From Great Britain ...	97,000	149,000	+ 52,000
Copper and copperware.—			
From Great Britain ...	102,000	43,000	– 59,000
,, New South Wales	67,000	325,000	+ 258,000
,, Other countries ...	1,000	69,000*	+ 68,000
Total ...	170,000	437,000	+ 267,000

* Victoria £67,000.

High C.P. Incandescent Lamp Fittings.—It is usual in many cases to enclose metal filament lamps of high c.p. in closed fittings. Experience has shown this method to be disadvantageous. A Swedish engineer, investigating the matter, has found that it is the rise in temperature which causes the rapid diminution in luminous intensity. He ran several incandescent lamps at temperatures of 200 deg. and 20 deg. C., while others cooled by a water-circulation device, were only at a temperature of 2 deg. or 3 deg. C. After some hours' running, in the case of the lamps at a temperature of 200 deg. C., the luminous intensity had dropped considerably, and they were unusable after 40 hours' running, whereas with the lamps run at 20 deg. and 3 deg. C., the diminution of intensity was inappreciable after this period. This is explained by the fact that at high temperature the glass of the bulb becomes porous and air enters the bulb. This also explains why, where a large number of lamps are arranged close together in advertisement signs, &c., they rapidly deteriorate.—*Technical Review.*

ELECTRICAL PROGRESS IN JAPAN.

[FROM A CORRESPONDENT.]

THERE are splendid opportunities, a great field and future for electricity and all its manifold uses and application in Japan. All the essentials for a prosperous electrical industry on a large scale occur there. The principal towns are populous, wealthy, and are governed by public authorities anxious to keep abreast of American and European progress, both as regards electricity and all other matters, sanitary, paving, sewage disposal, building construction, and so on, and, obviously of all these, electricity is the most important and most likely to benefit the largest number in the most varied ways. To some extent electricity has to compete with gas, but the former has nothing to fear from such competition; electricity for all purposes would grow in public estimation, in spite of half-a-dozen competitors such as gas. Many readers may not realise the extent and importance of Japan, its area in square miles is three times that of England, whilst the population far exceeds that of Great Britain without including Formosa, Korea, and other minor dependencies. The Japanese have all the necessary intelligence, energy and acumen to take advantage of their opportunities; geographically the country is well placed, a great variety of minerals occur, railways, harbours, a most varied climate, an enormous coast line, and an active, intelligent population. Most of the great towns and manufacturing centres where electricity has made the greatest headway are situated on the Pacific, or eastern coast of Japan, where the climate is more moderate than on the coast nearest Continental Asia, which is directly exposed to the north-eastern winds coming from the wide plains of Siberia; whilst the other coast benefits from equatorial currents which wash its shores, it is also protected by mountain ranges from cold Continental winds.

Electricity must necessarily be more useful to urban than to rural population; those interested in the electrical industry and its application, therefore, turn their attention mainly to the towns; there are no fewer than 30 with populations exceeding 50,000, of which one, Tokyo, has a population exceeding two millions, and another, Osaka, contains at least 1,300,000 persons. There are many other important and populous towns, which will compare with the best-known in Europe—Yokohama, Nagoya, and Kobe, with populations not far short of half a million each; Nagasaki, with 200,000 inhabitants, and many with populations of more than 100,000. In all of them electricity, in its many varied applications, is firmly established and extending; necessarily electric lighting and electric power are the most important.

Many companies are engaged, and a vast amount of capital has been invested in electrical enterprises. Within a decade the number of companies has increased five-fold and the paid-up capital over six-fold, as shown by the figures given below. The authorised capital has increased from £12,874,000 in 1907 to £21,490,000 during 1917:—

Year.	Number of companies.	Increase.	Paid-up capital.	Increase.
1907 ...	112	—	£8,090,000	—
1909 ...	147	35	14,166,000	£6,076,000
1911 ...	235	88	23,669,000	9,503,000
1913 ...	385	150	38,614,000	14,945,000
1914 ...	437	52	44,380,000	5,766,000
1915 ...	485	48	47,280,000	2,900,000
1916 ...	520	35	49,900,000	2,620,000

This list of electrical enterprises in Japan compares most favourably with a corresponding list of gas enterprises competing and covering the same period of time. The number of Japanese competing gas companies was only six in 1907, and not more than 91 in 1916; whilst the paid-up capital was only £953,000 in 1907 and £9,375,000 in 1916. As regards electrical enterprises in Japan, the average paid-up capital in 1907 was £72,000, and in 1916 it had increased to £95,000, nearly 35 per cent.

The popularity of electric lighting and power may be inferred from the vast increase in supply; the advance has been continuous without a set back, as shown by the figures given below:—

Year.	No. of electric lights.	Increase.	Electric power supplied in KW.	Increase.
1908 ...	1,230,876	371,733	46,265	13,000
1910 ...	2,141,810	910,934	75,578	29,313
1912 ...	4,499,627	2,357,817	131,340	55,762
1914 ...	7,706,962	3,207,335	177 940	46,600
1916 ...	9,975,554	2,268,592	200,400	22,460

For a population such as the Japanese, engaged in every variety of industry and trade, electric motors are necessarily indispensable; as soon as they were introduced, and their value understood, the demand increased by leaps and bounds, and within a decade the number multiplied no less than 22 fold. The electric power supplied in KW., and the horse-power, increased in like manner, as will be seen from the figures given below:—

Year.	Electric motors supplied.	Electric power in KW.	Horse-power.
1908 ...	3,975	8,391	11,249
1910 ...	7 970	17.241	23,111
1912 ...	18,092	32,994	44,055
1914 ...	35,309	79,964	107,273
1916 ...	54,064	175,532	235,470

A comparison of the number of electric motors in use in Japan, with the number of gas engines installed, shows how vastly more popular and useful the former are; in 1908 there were 1,484 gas engines, and in 1916 only 2,000 odd, against 54,064 electric motors. The average power in KW. per motor has increased between 1908 and 1916, from two to over three.

The electric motors operating in factories in Japan may be divided into two groups, those actuated by means of electricity generated within the factory, and those supplied from an outside source. The figures given below, like all others referring to electricity in Japan, show steady annual increases and a remarkable change of system, thus the horse-power of motors worked by electricity generated within the factory shows a notable decline from 184,837 H.P. down to 98,222 H.P., whilst the horse-power of motors actuated by electricity supplied from an outside source shows an increase from 98,726 H.P. to 195,164 H.P. Obviously experience must have shown that the latter system is the more economical; the tendency may be for it to entirely supersede the other:—

Year.	Electricity generated in the same factory. No. of motors.	Horse-power.	Electricity supplied from outside. No. of motors.	Horse-power.
1909 ...	993	28,562	1,691	16,959
1910 ...	1,801	66,844	1,723	26,411
1911 ...	2,880	121,395	2,286	52,215
1912 ...	3,535	110,620	3,336	50,319
1913 ...	3,818	184,837	5,053	98,726
1914 ...	3,039	79,493	6,935	121,341
1915 ...	2,892	94,510	8,485	124,759
1916 ...	3.547	98,222	12,885	195,164

The factories mentioned above may be classified, according to the output, into groups, including textile factories, iron and machine works, chemical works, food and drink factories, paper mills, soap, leather and dyeworks, miscellaneous and special factories; most of these groups may be again divided into sub-groups, thus the textile factories include spinning and weaving, cotton ginning and refining, knitting, braiding, embroidery, silk, and others. The machine and iron works include machine shops, ship building, carriage making, tool making, foundry, metal and metalware making. Food and drink factories include breweries sugar and tea mills, rice and flour mills, canning and bottling, and other works. The miscellaneous group includes printing and publishing, paper and leather goods, matting, and so on. The special factories include electrical factories and metal refineries. The largest group are the machine and iron factories; it requires in all 5,359 electric motors of 90,041 H.P.; of these 1,718, yielding 38,736 H.P., use electricity generated in the same factory; the other 3,641 use electricity supplied from an outside source; the main sub-groups are the shipbuilding and the foundry and metal-working industries. The second largest group of industries using electric motors are the textile factories, requiring 75,222 H.P. for 5,772 machines; spinning and weaving mills are the largest users of electric power in this group. The chemical factories are a good third, requiring 70,624 H.P. for 2,209 motors.

Of these three industrial groups the chemical factories require the more powerful motors, the average being 32 H.P.; the machine and iron factories come next with an average of 16½ H.P., whilst the textile factories use motors averaging only 13 H.P. each. The other groups only require electrical power on a very limited scale, the ceramic enterprises are limited to 19,715 H.P., and 709 motors; paper mills require 380 electric motors, and 26,648 H.P., the miscellaneous factories use 16,433 H.P. for 1,850 motors. Of the special factories, those devoted to electrical industry require 110 electric motors and 22,407 H.P. These details will give some insight into Japanese requirements, and may be found extremely useful to those desirous of supplying the Japanese market. It is noteworthy that the only industries in which the horse-power generated in the same factory, exceeds that supplied from outside, are for the production of explosives, artificial manures, sugar mills, and metal refining, and these are industries likely to be placed in more remote situations where outside supplies of electric power would not be available.

Passing on to another phase of the Japanese electrical industry, in the electrical works the operatives work 352 days in the year, and 3,120 are employed in all above 15 years of age, of whom only nine are females. Wages are, of course, extremely low compared with those paid in America and Europe; fortunately for exporters these Japanese electrical works are yet on a small scale. The average daily wages of men is only 27 cents, and of women less than half that amount.

As regards Government factories, no fewer than six departments use electric motors; five types of plant are employed, of which the following figures give a summary:—

Type.	Horse-power.	Type.	Horse-power.
Electric ...	5,922—150,828	Water	26—882
Steam ...	570—150,887	Petroleum ...	15—845
Gas	16— 2,860		

Taking the departments in detail, the Cabinet requires 593 electric motors of 10,001 H.P.; of these 111 of 889 H.P. are employed in the three factories of the Printing Office, and the others in the 21 factories of the Imperial Railway Board. The Finance Department uses 490 electric motors of 5,214 H.P., of which 69 of 753 H.P. are placed in the Mint, and the others are required in the 63 factories of the Monopoly Bureau.

The Military Department at the Tokio and Osaka Military Arsenals and six other factories have fitted up 1,310 electric motors of 27,605 H.P.; whilst the Navy Department in the Yokosuka Naval Arsenal, and 21 other factories, employ 2,534 motors of 72,465 H.P. The Department of Agriculture and Commerce in

its steel foundry, uses 986 electric motors of 34,475 H.P. The only other Department is that of Communication, which does its work in the Typographical Printing Office, and two other factories, where there are nine electric motors of 68 H.P.

All interested in the practical and successful establishment of electricity, must realise from these details that it has taken a firm hold of Japanese expert opinion, and that it can, and will, hold its own against all competition.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Lay-out of Switchgear.

The letters under this heading from Mr. A. J. Webber and Mr. J. Walker are both interesting and instructive. I find that switchgear makers generally do not advocate the use of fuses for currents above 350-400 amps. For currents of greater value, it is more economical in the end to use circuit breakers.

With regard to the trouble experienced by Mr. Walker, due to broken fuse carriers, I would inform him that there is an unbreakable fuse carrier on the market which is built up into various forms of ironclad switchboards. This carrier is constructed on the metal-mica principle, and has an aluminium handle; there is ample allowance for ventilation, and at the same time full protection for the operator.

If Mr. Walker desires it, I shall be pleased to give him full particulars of this apparatus, which has superseded the old-fashioned gear at many leading steelworks, collieries, shipyards, &c.

S. H. Finney.

Manchester,
December 16th, 1919.

The Speeding-up of an Induction Motor.

I have read with interest the correspondence on the above subject. I cannot understand how such an occurrence could be treated so casually.

If the first speed was wrong, how was it passed by an engineer? Twenty per cent. is a large amount. If the second speed was wrong, surely it should have been investigated. The remedy was to fit a smaller pulley! It would have helped if "Puzzled" had stated the speed for which the motor was designed or the number of poles.

If the first speed was right, then the fault must have been the cutting-out of a pair or more of poles, as the frequency did not alter.

If the second speed was right, there must have been some extra resistance in the rotor circuit, and on something causing the fault to disappear the correct speed was regained.

Although an earth would bring out the breaker, a pair of poles shorted in their own windings might not. A short of this nature would probably manifest itself in unusual humming of the machine. The short-circuiting contacts would have to be good or burning of the insulation and winding would result.

If the starting resistance was not entirely cut out it would reduce the speed, but it is hardly likely that the machine could work for twelve months like this without ruining the starter, unless the latter was unusually robust.

A very badly soldered joint in the rotor winding would decrease the speed, and it is possible that on some unusually heavy load coming on, the solder would be melted and improve the connection (especially if the joint was wrapped so as to prevent solder flying out).

If a 12-pole machine, speed 500 R.P.M., had a pair of poles cut out it would speed up 20 per cent., *i.e.*, to 600 R.P.M. (neglecting slip).

I should like to hear the correct solution of the trouble.

E. R. Sanderson.

Whiston, *December 16th*, 1919.

[Our correspondent's suggestions are very interesting. But cutting-out a pair of poles by short circuit, without changing the pole-pitch, would not materially affect the speed of rotation, though it would have a marked effect on the magnetic balance of the machine.—EDS. ELEC. REV.]

With reference to "Puzzled's" letters regarding the speeding up of an induction motor, it would be interesting to ascertain the cause of this, and perhaps he will be good enough to give a little further information to work on, viz., the number of stator slots; style of winding, *i.e.*, spiral or lap coil; the original or nominal speed of motor; the actual increase in speed, and if the speed is constant, or is there a tendency to "hunt"? Has he taken ammeter readings in each phase, and if so, what are the readings? Has the motor run with the neutral temporarily disconnected from earth? and what tests have been made on windings apart from the insulation "earth" tests?

B. T. D.

Swansea.

The New Copper Wire Standards.

The correspondence which has appeared in your columns during the past few weeks on the new standard sizes for copper conductors in wires and cables has been most interesting, particularly to those whose chief aim at present is to provide the users of electric cable with the material necessary for their work with the minimum possible delay. The most immediate question to be decided is whether the wire used for inexpensive house wiring shall be 1/18 S.W.G. (.048 in. dia.) as heretofore or .044 in. dia.

The Wiring Rules Committee of the Institution of Electrical Engineers, even with my friend Mr. L. B. Atkinson to urge them with the whole force of the C.M.A. at his back, have evidently not quite made up their minds. They have altered their table to include 1/.044, but they have also added 1/.036 (1/20 S.W.G.) which is admittedly too small for the ordinary wiring circuits, so that the conclusion is left to be drawn that the excellent Rule 39, which lays down 1/18 S.W.G. as the minimum size for this purpose, remains unaltered. Let them, therefore, have the courage of their convictions, although it is a rare thing nowadays, and definitely issue an official pronouncement to this effect. The reinstatement of 1/.048 in their wiring table can then follow.

There can be no doubt that there is always room for a class of wiring in which a smaller conductor than 3/22 (3/.028) or 3/.029 is admissible. The demand for 1/18 S.W.G. will therefore continue, and will be met, in spite of the new standards of the British Engineering Standards Association—with the inception of which the Cable Makers' Association were far more intimately concerned than Mr. Atkinson's modest explanation would lead one to suppose. So long as this demand continues there should be no attempt to throttle it, and my firm—and presumably those few others with wire-drawing plant at their own works—have no difficulty in supplying it.

Personally, I should regret the wholesale use of 1/.044 wire for house-wiring, although it would be harmless for small circuits in wood casing; if, however, the Institution of Electrical Engineers is really considering the question of recognising it, let it do so quickly, so that we can get ahead preparing for the rush for it which is bound to follow. It should be pointed out, however, that the benefit of price over 1/18 is not very great; there is only one-thousandth of an inch difference in the radial thickness of insulation, so that practically the only gain is in the slightly decreased cost of the copper itself.

Lastly, let me put in an emphatic protest against the suggestions made by Mr. Turnbull and Mr. Munro for new standard nomenclature. At present our hard-worked estimating departments have to deal with inquiries for the same conductors expressed in S.W.G., in diameter, mils diameter, sq. in. millimetres diameter, sq. mm., B. & G. gauge, and circular mils, not to mention "to carry . . . amps" (without statement of length or allowable fall of potential) and "for a . . . H.P. motor" (without voltage or other data). For goodness sake let us not have a new set of No. 10's, 15's, 20's and 30's, nor square mils, inares, decinares, centinares, milinares—or nightmares.

For the **Edison-Swan Electric Co., Ltd.,**
F. CHARLES RAPHAEL,
Manager, Cable and Wire Department.

Ponders End, Middlesex,
December 19th, 1919.

[The I.E.E. recognition of the 0.0015 sq. in. conductor arrived simultaneously with Capt. Raphael's letter, and is printed elsewhere in this issue.—EDS. ELEC. REV.]

Electricity Supply.

Even within the relatively small world of the electrical industry the multiplicity of events is apt to produce confusion of their sequence, and subsequent history based on memory and hearsay tends to be inaccurate.

I think it right, therefore, before the turmoil in connection with the Electricity (Supply) Bill subsides, that some acknowledgments should be expressed to those members of the industry who have laboured so assiduously and successfully to get this Bill amended.

We all like to be on the winning side, and the attitude of many of the supporters of the original Bill has already changed. Some of them are expressing unfeigned satisfaction with the drastic amendments that have been made, and soon it will be impossible to distinguish between those who supported the Bill in its original form and those who made gallant efforts to get it into a form less prejudicial to the future of the industry.

When last year the various reports of the Board of Trade Committees and of the Coal Conservation Sub-Committee of the Ministry of Reconstruction appeared, many of us felt that they did not indicate any satisfactory basis for general legislation in regard to the complex technical, administrative and financial problems of electric supply reform. It was while we were groping about for a formula for which we might hope to secure unanimity among those concerned that Mr. Highfield made a suggestion that we should support the proposal for the appointment of permanent and qualified Commissioners,

but that we should strongly oppose the formation of District Boards and the compulsory and premature expropriation of the undertakings. The statesmanlike character of the policy indicated by Mr. Highfield was immediately recognised, and I did not hesitate to give it my full support.

We are also greatly indebted to Mr. Wordingham, then president of the Institution of Electrical Engineers, for the facilities he provided to enable the Committee of the Representative Associations to discuss the situation, and for the great assistance he gave by presiding over the deliberations of the Committee. The outcome of the deliberations was in effect the endorsement of Mr. Highfield's suggestion.

The Board of Trade did not adopt the recommendations made by the Committee appointed by the Institution of Electrical Engineers, but proceeded with the Bill which was drafted more or less on the compromise of divergent views recommended by the Williamson Committee.

With my recollection of all previous electrical legislation, I cannot remember an Electrical Bill which has met with such general and spontaneous opposition as this one, and we cannot be too grateful to all who so strongly supported the cause during its passage through the House of Commons and in its first stage in the House of Lords.

In substance the Bill as now amended by the Government is limited to the appointment of Commissioners, with powers to examine and explore the whole situation. They will have no compulsory powers, and the confiscatory clauses of the Bill as it left the Commons are deleted.

It remains to be seen whether the industry will be able to take full advantage of the measure of freedom now promised to it.

E. Garcke.

London, W.C., *December 19th*, 1919.

The Ship as a Power Station.

Many electricity undertakings in the country are now faced with large demands for power which they are unable to supply, owing to the war and the Electricity Bill having stopped extensions to plant, and from the latest phase of the Bill it looks as if this industry is to be held up for a further prolonged period—many undertakings faced with costly and urgent extensions cannot move until the Government policy is clear.

The following proposal for temporarily and immediately meeting the difficulty in seaboard towns looks on the face of it a feasible proposition, but I am finding it difficult to obtain any information about it as regards cost.

The proposal is to buy or hire a steamship which is in itself a complete power plant, and install an alternator in place of the propeller.

Can you give me or elicit any reliable information to show whether this proposal is commercially and technically practicable or not?

Worried.

December 17th, 1919.

[We have never regarded this proposal seriously; it is impossible to believe, with shipping at its present price, that the cost would not be prohibitive. It is somewhat like burning down the house to roast the pig.—Eds. Elec. Rev.]

LEGAL.

Farrant *v.* County of London Electric Supply Co., Ltd. Judgment.

In the City of London Court, on December 18th, Sir John Paget, K.C., deputy judge, delivered considered judgment in a case already reported in the columns of the Electrical Review, in which the widow of a cable jointer named Farrant claimed £300 against defendants as compensation for the death of her husband, who was killed in a switch room by an 11,000-volt current passing through his body while working for them at their high pressure power station at Mitcham Lane. Defendants, while regretting the accident, said that Farrant ought not to have gone into the switchroom until he had ascertained that the power had been turned off, and therefore no responsibility rested with them.

Sir John Paget, K.C., in giving judgment, dealt with the circumstances and the evidence in some detail. He found that Farrant received no intimation from Boulger, a foreman, that the work was to begin at midday. Humphreys said that he did not know the actual time when the station would be dead, and he did not remember telling Farrant this. He (the judge) found that no notice of this sort ever reached Farrant. Wootton never locked the switchroom door after he first unlocked it. It was also clear that the transformer room door was at that time unlocked and open. Elliott said he was working behind the dead switch, so that presumably one at least in this switchroom was out of action. There was no guard or other protection on any of the live parts in the switchroom except that afforded by the door when locked; it was contended such precautions were unnecessary, the sub-station being a place set apart within the meaning of the regulations. Farrant was found on the left-hand side of the switchroom. He died from the injury received, and compensation if recoverable was agreed at £300. The payment was disputed on two grounds. First, that Farrant in entering the switchroom was disobeying statutory regulations and private rules of the respondents. Second, that he incurred an added or imported peril in so doing, and that on both or one of these grounds the accident did not arise out of and in the course of his employment. The judge first dealt with the private rules of the respondent company. The rule relied on was No. 18. "No one is allowed to enter into any E.H.P. sub-station, except those in charge of the station." The judge was not satisfied that this rule was ever accepted or agreed to by Farrant. Farrant's signature was produced and proved, but though there were definite signed statements by some of the cable jointers, of whom Farrant was one, there was none on the part of Farrant. Dallas, respondents' own witness said in cross-examination: "There is nothing here to show Farrant has received and agreed." It was sought to supplement this evidence by that of Knott, but he ruled that this carried the matter no further. This seemed to him to put the case on this point on all fours with Richardson *v.* Denton Colliery, 6, Butterworth 629, where Cozens Hardy, L.J., said this was "no proof that the man had been furnished with a copy of these rules—not a particle of evidence even to suggest that he knew he was doing wrong in travelling as he did in the tub. The evidence, to my mind, of his good faith is overwhelming." Moreover, if Farrant had notice of this rule, it was obvious that the rule could not be interpreted in its strict sense. Work had to be done in this sub-station by others than those in charge of the station. Elliott was working there. Humphreys was told to work there. It was not a statutory rule which could not be abrogated by the employers. Either it must be read as being subject to some such notification as "without the permission of those in charge," or not being statutory it must be regarded as having been nullified on this occasion by the conduct of deceased's superiors hereinafter referred to. There was no evidence of its having been habitually disregarded, but in view of the fact that cable jointing and like work necessitated the presence of workmen in the sub-station, it was difficult to conceive its having been adhered to strictly on previous occasions any more than it was on this. If the former, it came under the same treatment as the statutory rule; if the latter, it did not bar compensation. As to the statutory rules, these, according to the witness Dallas, were displayed throughout the works, and he would assume that as in Barnes *v.* The Nunnery Colliery, 1912, A.C., 44, they were binding on the deceased as having been brought to his notice. The rule to which his attention was mainly directed was rule 15, par 2: "No person excepting an authorised person or a person acting under his immediate supervision shall for the purpose of carrying out any work have access to any part of an area so set apart." Now, associated as this was with the first paragraph which enjoined the duty of fencing or enclosing dangerous switchboards except in an area set apart it was clearly obligatory on the employers or their authorised agents. Access was means of approach, and it was the employers' business to preclude this, a duty in which they had failed in the present instance. Mr. Willis's note on Crooks *v.* Greenwood, 11, Butterworth, 128, was as follows: "Employers cannot avoid liability by alleging a breach of rule against working a machine without a guard when it is their duty to provide a guard, and they have not done so." Sir John said he was not clear that the case fully bore out the proposition, and though it was in a way connected with the present case, he did not found his judgment on this ground. Then there was rule 31: "Every sub-station shall be under the control of an authorised person, and none but an authorised person or a person acting under his immediate supervision shall enter any part thereof where there may be danger." Now to this, as to the statutory rule in Richardson *v.* Denton Colliery, 6, Butterworth, 629, Swinfen Eady, L.J.'s, remarks apply. He says: "It will be observed the rules do not contain any absolute prohibition against colliers riding in tubs. The rule is, 'no person shall ride in any tub except where permitted by the manager or underlooker,' so giving permission for riding in tubs is contemplated." In the present case there was a further qualification, "where there may be danger." Who was to judge whether there might be danger or not, the authorised person or the workman? *Prima facie*, he would say the authorised person. Indeed, the whole tone of the rule, like rule 15, seemed directed rather to the employer than the employed. Assuming this rule to bind Farrant, did he act in disobedience to it so as to make the accident one not in the course of and arising out of his employment, or one resulting from his having voluntarily incurred an added risk, which was as Lord Dunedin said in L. & Y. Railway *v.* Highley, 1917, A.C., p. 365, only a convenient test of the other proposition? He found that he did not. In his opinion, he was acting under the immediate supervision of one authorised person if not two. Wootton was there, and Boulger, according to his own statement, was there. Wootton showed Humphreys and Farrant the work to be done, and then went with Humphreys into the transformer room to show him work there, leaving the switchroom door unlocked and open, and Farrant either in the switchroom or just outside. Supervision need not mean actually standing over the men while at work. The respondents clearly did

not so understand it, as Elliott had been at work alone in the transformer room for about two hours before the accident and had been put there by Boulger. Both doors were open, and it looked very much as if that was all the supervision that was being or going to be exercised. It could not, of course, be ascertained whether Farrant saw Elliott. Elliott saw him; it seemed to Sir John probable he saw Elliott when, as the latter said, he put his head through the hole in the party wall, or heard him chipping the brick wall. If so, he would be justified in assuming that the sub-station was under supervision. Then as to "where there may be danger," he was inclined to believe this clause was as much directed to the employers or their agents as to the workman. Anyhow, the estimation of the danger on the part of the workman could only be a mental process based on existing circumstances. Here Farrant saw the doors open, the only possible safeguard, if the station was live, being according to Dallas, the switchroom door locked. Wootton had shown the work and said nothing about the wires being live, or so far as deceased was concerned, when work was to begin. He probably saw or heard Elliott, or saw the holes in the party wall, and apparently one switch pillar was actually out of action. It was an invitation, if not a trap. Farrant was entitled to assume that his superiors were discharging that duty, and he saw nothing to suggest danger to his mind. As to why Farrant went in must, of course, be matter of speculation. This was not one of the cases where any exterior personal reason could be suggested. It was not like a man going to a canteen, or taking a short cut, or riding when he could walk. One of respondents' own witnesses, Boulger, disclaimed any such idea, and was of opinion that Farrant went to have a first-hand look at the work to be done. He thought that was the most probable explanation. If so, the doing so was, to his mind, within the scope of his employment. As Farwell, L.J., said in Gane *v.* the Norton Hill Colliery, quoted by Lord Atkinson in L. & Y. Railway *v.* Highley, the employment was not confined to actual work. It extended to all things which the workman was entitled by the contract of employment expressly or impliedly to do," or it was reasonably incidental to his employment, which Lord Sumner had mentioned as one of his tests. As Duke, L.J., said in Dawson *v.* G.C. Railway: "There is a presumption that if he was not engaged in doing an unauthorised act he was within the scope of his employment." The question of added peril was really on the same footing. The conditions all pointed to there being no extraneous danger, and Farrant had no opportunity and materials on which to exercise that independent volition and choice which Sir John considered an essential element in the matter. In Richardson *v.* Denton Swinfen Eady, L.J., said: "It seems to me impossible on this evidence to draw the inference that the collier who lost his life knew he was forbidden to ride in the tub." *Mutatis mutandis*, these remarks applied to the present case. If being in the switch house Farrant was negligent in stretching out his arm to the live switch pillar, as apparently he did, or in not noticing that the indicator pointed to "on," that would not deprive his dependents of the right to compensation. In view of the remarks of Duke, L.J., in Bointon's case, and of possible further proceedings, he found that Wootton was guilty of negligence in leaving the switch room door unlocked. He found therefore, in conclusion, that Farrant died from an accident in the course of and arising out of his employment, and he awarded the applicant, his widow, £300, the agreed amount, and costs.

In reply to Mr. Duckworth, his Honour allowed costs on scale C. Some discussion took place as to the cost of certain evidence.

Mr. Scanlon asked for a stay of execution with a view to giving the respondents an opportunity of considering an appeal.

The Deputy Judge agreed, but said he did not want to keep the poor lady out of her money.

Scott Anderson *v.* Clayton & Shuttleworth, Ltd.

In the Commercial Court of the King's Bench Division on December 18th, Mr. Justice Roche continued the hearing of this action (Elec. Rev., December 19th, p. 779).

The case had been adjourned from December 9th, when it was suggested defendants might be able to obtain a licence to use the goods, and evidence was now given on behalf of the Quasi Arc Co. that they were not prepared to grant a licence to the defendants to use the electrodes.

Giving judgment, Mr. Justice Roche said the plaintiff was suing for the price of certain electrodes covered with asbestos fibre, intended to be used in electric welding process. It had been agreed by counsel that the property in the goods had passed to the defendants. The price of the goods (100,000 feet of electrodes) was £750, and the claim being admitted, plaintiff was entitled to judgment for that sum. The real question discussed before him was the question of the defendants' counter-claim. When the goods were agreed to be bought and sold there was a question as to the right of the plaintiff to manufacture and sell the goods. The counter-claim was based upon the ground that the Quasi Arc Co. had obtained an injunction against the plaintiff, and that accordingly the 100,000 feet of electrodes had become useless to the defendants because they were not able to use them, and they asserted, in the circumstances, that their damages amounted to the whole price of the electrodes less a very small sum for the value of the goods as scrap. Defendants' counter-claim was based upon the express warranty given, and he (the Judge) held that the plaintiff was responsible to the defendant company. He held that the plaintiff, in making these electrodes, was infringing the patent of the Quasi Arc Co. He was satisfied that owing to a change in the defendants' business the goods had become of much less value to them than the £750 which they had agreed to pay. He held the value of the goods would not have amounted to more than £500 at the material times. His Lordship gave judgment for the plaintiff for £750 on the claim and judgment for the defendants for £500 on the counter-claim, and there would be a set off and the balance paid, whatever it was.

Edwards *v.* Hewlett.

In the City of London Court, on December 16th, this case, which has already been referred to in these columns, was mentioned to his Honour Judge Atherley-Jones, K.C. It was a claim by Mr. Ernest E. Edwards, electrical engineer, Cullum Street, E.C., against Mr. Harry Hewlett, publican, of Stepney, to recover £39 14s., balance of £45 9s., for electric wiring, supplying lamps, and for other electric fittings at the defendant's public house.

Mr. Greenop, plaintiff's solicitor, said that at the trial the defence set up was that the plaintiff had contracted to do the whole work for £15. That failed, and the judge referred the question to Mr. J. H. Scott, Dock House, Billiter Street, who was to survey the premises, and say how much was to be paid by the defendant. The report at first was by no means clear. It said that after careful perusal he found that in examining the value of the goods supplied for work done £35 would amply cover the same, with the exception of the wiring four brackets in the bar. He recommended the plaintiff to revise the charge. Mr. Scott had since reviewed the matter. There was an agreement that the plaintiff should allow £6 in respect of some lamps which the defendant said had been returned. That £6 was to be deducted from the £35 12s. 6d. to which the claim was reduced, which left £29 12s. 6d. Plaintiff had received £5 15s. on account before action. Therefore judgment would be given for the plaintiff for £23 17s. 6d. and costs.

A representative of the defendant's solicitor opposed the application, but it was granted.

BUSINESS NOTES.

"The Compliments of the Season."—To those of our readers who receive this number of the Electrical Review in time we desire to offer our hearty good wishes for a "Merry Christmas." To all of our readers and supporters we wish a most prosperous New Year. There are many reasons, upon which we need not dwell, why this Xmas should be better than any experienced for some years (notwithstanding the restrictions for some, due to the high cost of living), and why we should look forward hopefully to the year 1920.

Xmas Messages.—The current issue of the *Ex-Service Man* contains Xmas Messages to those who served in the Forces, from Field-Marshal Earl Haig, Admiral Earl Beatty, Sir Hugh Trenchard, General Lord Byng, Lord Lee of Fareham (Agriculture), Sir L. Worthington Evans (Pensions), and Sir R. Horne (Labour Minister).

Trade Returns.—In the *Board of Trade Journal* for December 18th will be found particulars of a number of amendments that are to be made in the form of the Trade Accounts and the Import and Export Lists of the United Kingdom in 1920. Instead of the old alphabetical lists there will be in the annual returns the same classification and grouping of articles as used in the monthly Board of Trade Returns. More articles are to be detailed by quantity or weight as well as by value.

British Manufacturers in South Africa.—The representative organisation in South Africa to look after the interests of United Kingdom manufacturers, which was proposed several months ago has now been formed. The subscription is two guineas, and the *Board of Trade Journal* suggests that manufacturers interested should instruct their S. African representatives to make application for membership to Mr. W. G. Wickham, H.M Senior Trade Commissioner there (P.O., Box 839, Johannesburg).

New Italian Electrical Company.—The Società per Elettrotecnica Silect di R Fioravanti e Ca. is the style of a new company formed at Milan, with a capital of 50,000 lire.

British Trade Interests in Spain.—Mr. R. T. Nugent, the Director of the Federation of British Industries, has just returned from a visit to the office of the Federation's Trade Commissioner in Madrid. He was accompanied by Mr. C. F. I.

Ramsden, who visited Valencia and Barcelona, to inquire into the proposed exhibitions to be held in these two places. It is the policy of the Federation to engage floor space in such foreign exhibitions as are likely to be of benefit to British manufacturers exhibiting there. Colonel Thoroton, who during the war was in charge of the British Government's Commercial Intelligence Organisation in Spain, is the Federation's Trade Commissioner in Madrid. We understand that representatives of British business houses in Spain welcome the presence of the Federation, as it is of great assistance to them and to the cause of British trade as a whole, for it forms a centre for British commercial interests in that country. The arrival of the Federation with a suitable Commissioner, competent staff, and a fine office in the best centre of Madrid, has been a valuable collective advertisement for British industry in general. It has also given the impression that the British manufacturer is taking the Spanish market with real seriousness.

Calendars, Diaries, &c.—We have received from the Sun Electrical Co., Ltd., of 57-59, Neal Street, Long Acre, W.C. 2, one of their "Sunco" desk memo. calendars on metal base, with daily slips for 1920. Each slip contains some saying, wise or otherwise ("A short saying oft contains much wisdom"), and as we turn them over, and are impressed with their sterling worth, we select as indicating the profound character of "Sunco" wisdom, two representative types that casually meet our eye:—"Every wise old dog was once a silly pup," "Opportunity, sooner or later, comes to all." To "Sunco" friends who already have the steel bases, refills are being sent, but new bases will be forwarded to both these and other friends, if application be made on business notepaper.

The Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, have issued their 1920 desk blotting pad. Each sheet has a calendar for the year. The company have also issued a very large wall calendar, with big monthly sheets (art paper) setting out the dates in large black and red figuring. Above the sheets are illustrations of a number of Hart motor-car starter and lighting batteries, power-station batteries, &c.

The Tok Manufacturing Co., Ltd., send us a many-coloured card suggesting that the Tok switch was used by the prehistoric cave-man, and wishing us a "Tok-hole Xmas, and a Snap-switch New Year." We presume that the intention is good, and are duly grateful.

The Key Engineering Co, Ltd., have sent us one of their celluloid vest pocket calendars for 1920, together with the information that they are now again able to deliver their fibre conduit and troughing from stock.

Messrs. Fredk. Hodgson & Co., Ltd., 24, Queen Victoria Street, E.C. 4, have sent us a calendar illustrated with an excellent coloured reproduction of a Highland scene, "Morning on the Loch," as well as a handy telephone directory for hanging on the wall.

From the Davenport Engineering Co., Ltd., of Bradford, we have received a wall calendar with a block of daily slips for 1920.

Messrs. Simplex Conduits, Ltd., have sent us a handsome pocket wallet and diary, and a hefty pocket screw-driver with three bits, such as would delight the heart of a schoolboy with leanings towards engineering—altogether a pair of very acceptable Christmas souvenirs.

Messrs. Haslam & Stretton, Ltd., of 11, Windsor Place, Cardiff, have produced a most acceptable wall calendar. "Gladys" is a charming and captivating study, and her presence will add sweetness to any office or private apartments. The date slips are quite unobtrusive.

Messrs. Swarren, Ltd., electrical-power engineers, of 52 and 54, Theobald's Road, W.C. 1, have issued to their friends a somewhat similar wall calendar. The slips are hidden beneath a white card bearing words wishing peace and prosperity. The subject is a study of a girl in summer attire of green and roses. She is nameless, but the letterpress above counsels you to "in case of breakdown, 'phone"——

E.D.A. Activities.—From the Electrical Development Association we have received a pamphlet (E.D.A. 1/2) on "Housing Construction and Electricity Supply," and a quantity of other interesting matter which is now available for distribution.

Book Notices.—"List of Officers and Members of the Institution of Electrical Engineers" (corrected to October, 1919). London: The Institution.—The list shows a total membership of 7,792, of which Members number 1,583, Associate Members 4,243, and Associates 521. A short account is given of the history and objects of the Institution, and a topographical list of members has been added, which will prove very useful. We note that in London there are no fewer than 2,080 members; Manchester comes next with 315 members.

The Technical Inspection Association, recently formed, has just issued the first number of its *Gazette*. The front page is given to a description of the aims and objects of the Association, which, briefly stated, are:—(1) Social intercourse and mutual assistance; (2) the advancement of science and industry by promoting the efficiency of inspection; and (3) the conservation and co-ordination for the national use of the experience brought together by the war. The body of the magazine is devoted to records of the Association's proceedings, and includes the following papers:—"The Spectroscope in the Science of To-day," by Prof. E. C. C. Baly, F.R.S., &c., and "The Inspection and Testing of Materials," by Messrs. R. D. Summerfield and H. J. Davey.

Lighting from Concealed Sources. New York: National X-Ray Reflector Co.—This book is a worthy addition to an electrical engineer's library, for it is without any doubt the finest trade publication relating to illumination that we have yet seen. It speaks well for American enterprise, and we venture to say that it will be a long time before any English firm puts in front of its potential clients such a work as this. Attractively bound and printed on good paper, with ample illustration and explanatory letterpress, it is a triumph of advertisement. The reading matter enables one to appreciate the foundations of good lighting, the *raison d'être* of concealed lighting, its advantages, and the calculations and precautions necessary to ensure its satisfactory installation. Almost every type of application is illustrated, and interesting details of construction and fitting are given, with diagrams and sketches, so that the reader may figure out similar arrangements for his own purpose. There are a few examples appertaining to British installations, which have already appeared in our columns. Architects will be especially interested in the novel details set forth, and the circulation of such a work as this amongst the fraternity should do much to secure their active co-operation at the right moment, for too often is the question of illumination shelved for later consideration, or treated merely as a matter of fittings. Works engineers will find that those pages relating to direct lighting hold much to interest them, and the reproductions of industrial installations are excellent. The direct lighting of shops, sports rooms, museums, theatres, &c., is fully treated, and a special section is devoted to show-window lighting, a purpose for which the type of reflector referred to is excellent. Flood lighting is a relatively new departure for the firm, but it is obvious that it has made tremendous headway in such matters. The book concludes with a mass of illumination data and a comprehensive index. The work is a monument to the efforts of the president of the National X-ray Reflector Co., Augustus D. Curtis, and to the chief engineer, T. L. Stair, who are mainly responsible for its production; it illustrates in a most striking manner how research, service, and organisation assist both producer and consumer; it serves also to emphasise the conservatism of the British manufacturer.

Automatic Recording Instruments. Reprinted from the *Mechanical Engineer*. Manchester: Scientific Publishing Co. Price 3s. 6d. Pp. 202 + viii: 236 figs.—This reprinted series of articles deals with a selection from the recording instruments of Messrs. Schäffer & Budenberg, Ltd. In the introduction interesting information is given regarding charts, pens, &c. The remainder of the work is divided into three sections, dealing respectively with "short-period" graphic recorders for pressures, temperatures, speed, &c.; "continuous" recorders, and "figure" or integrating recorders. Electrical apparatus does not figure largely in the book, but a remarkable variety of devices covering a wide range of applications is described, and a good deal of information on recording methods in general is included.

How to Lay-Out Turret Lathe Tools. Coventry: Alfred Herbert, Ltd. Second edition. Pp. 167; 164 figs. Price 6s. Post free.—The great increase in the use of capstan and turret lathes in this country during the war, and the necessity of diverting them to new tasks, have created a need for a clear statement of the principles that must be followed in order to attain success. This handsomely-produced volume covers the field very fully, and starting from the very beginning, discusses the problem with the aid of excellent line and tone illustrations at every stage; it is full of workshop hints, and numerous examples of work are shown, largely derived from munitions of war. A concluding chapter emphasises the advantages of simplicity and the danger of an excess of ingenuity in designing special tools which "spend most of their time in the tool room being kept in repair."

Trade Announcements.—The *Iron and Coal Trades Review* offices have been removed to Bessemer House, Adelphi, Strand, London, W.C. 2.

The plant, goodwill, and stock-in-trade of the Bentham Electric Supply Co., Ltd., have been sold as a going concern in one lot.

Mr. A. H. Hunt has removed from Cannon Street to new offices, warehouses and works at H.A.H. Works, Tunstall Road, Croydon, and all communications should be addressed there. Telephone: "Croydon 2225 and 2226." Telegrams: "Keyage, Croydon."

British Trade Interests in Greece.—Mr. G. H. Locock, C.M.G., Assistant Director of the Federation of British Industries, has recently returned from Athens, where the exhibition of British manufactures was so successful. On his way home from Athens, he had an interesting conversation while in Paris with Monsieur Venizelos, who was more than satisfied with the good feeling created by the exhibition, and said he felt assured it would lead to a fruitful interchange of commerce between his country and the United Kingdom.

Profiteering Act.—Before the Camberwell Profiteering Committee, Mr. Scott Flemming, electrical engineer, of Denmark Hill, appeared to answer the complaint of alleged overcharging made by Mr. C. Kipgsley for four electrical blocks, for which he paid 2s 8d. Complainant, who did not appear, wrote stating that they could be purchased elsewhere at 3s. 6d. per dozen. Mr. Flemming produced an invoice showing that he paid 6s. 6d. a dozen for the blocks, and the case was dismissed.

Catalogues and Lists. — Messrs. Cammell, Laird and Co., Ltd., 3, Central Buildings, Westminster, S.W. 1, have issued one of the finest industrial brochures that we have seen for quite a long time. There is a brief account of the history of the

development of the concern from its origin in a very small way in 1837, down to the vastness of its present operations in, and establishments for, iron and steel production, rolling-stock construction, naval and mercantile shipbuilding. This is followed by a collection of choice pictures, printed in colours, some of the views showing battleships and merchant vessels, while others depict operations in full swing in various departments in the production of armour plate, forging and machining gun and ship shafting, rolling steel for shells, forging and machining shells, rolling tires, making coil springs, making and forging crucible tool steel, forging and cutting files, &c. A high-class art paper is used, and in every detail—lay-out, printing, illustration, and so forth—there is such a tone as cannot fail to convey an impression of quality. Firms who are ambitious to produce publicity literature which is intended to create a favourable first impression upon the buyer, and to give evidence of substantial character, might do worse than take this brochure as an example.

British Insulated & Helsby Cables, Ltd., Prescot and Helsby.—"Catálogo General," a list of B.I. products, including cables, joint and terminal boxes, distribution pillars, cut-outs, and noiseless gears. Printed in Spanish, and well illustrated.

Messrs. Ernest Wood, Ltd., Station Buildings, Altrincham.—Pamphlet illustrating the "Hoover" electric suction sweeper.

Alloy Welding Processes, Ltd., 14-16, Cockspur Street, S.W. 1.—Bulletins Nos. 10, 27, and 31, illustrating and describing "A.W.P." standard electrodes, welding plant, and materials.

Messrs. A. Verey & Co., Ltd., 52A, Bow Lane, Queen Victoria Street, E.C.4.—List No. 501, cast-iron water-tight fittings for standard and half-watt lamps. Priced and illustrated.

The A. & A. Electrical Co., Ltd., 13, Farringdon Road, E.C.1.—Lists F-15, 16 and 17, illustrated pamphlets describing a wet tool-grinder, the "Warburton" electric friction hoist and starters for D.C. and 3-phase A.C. motors.

Italian Iron Supplies.—From an investigation made by the Associazione Metallurgica Italiana, it appears that Italy possesses native iron to no very considerable extent, and resort to foreign supplies must be made at no distant date. At the beginning of the war, Italian iron was furnished principally by the Island of Elba, whence it was sent to the various blast furnaces of the country. Thus in 1914, of a total output for the whole kingdom of 706,246 tons, the Island contributed 649,561 tons. On the other hand, the Valdaspra mine in the Province of Grosseto, produced only 36,000 tons, the rest being furnished by the deposits at Iglesias (Sardinia) and at Bergamasco. From 1909 to 1914, 250,000 tons of ore were mined in Elba. During the war the output was greatly augmented. In 1917, Italian mines yielded 942,244 tons, and in 1918, 1,000,000 tons, the greater part contributed by the Island of Elba. But in a short time, these beds will be exhausted. The war gave a spur to the search for new ore-beds throughout Italy. The first outcome of these efforts was the find of the ore-field in the Val di Cogore, where 6,000,000 tons were located, utilisation of which has only recently been begun by the firm of Ansaldo with two electric furnaces of Swedish type. The second find during the war was on the district of Morra in Sardinia, where an ore-field of an estimated 6,000,000 tons of ore was brought to light. The following are the present indications of the extent of Italy's ore reserves:—Traverselle, 1,000,000 tons; Cogne, 5,000,000 tons; Val Brembona, 200,000 tons, and various smaller fields elsewhere, making a total of, say, 24,000,000 tons. This total must be used up within a few years.—*Rivista Tecnica d'Elettricità.*

Bankruptcy Proceedings.—Mr. Cecil Saul Nathan, 97, New Bond-street, W.—An application for an order of discharge was made to Mr. Registrar Francke, at the London Bankruptcy Court, on December 19th, on behalf of this bankrupt, who formerly carried on an electric light installation contracting business at 39, Victoria Street, Westminster, and also acted as agent for the Brush Electrical Engineering Co., Ltd. He failed in July, 1919, with liabilities of £6,050 and assets 10s. 8d. The failure was attributed by the bankrupt to liabilities under guarantees given on behalf of other persons. The application was opposed by the Official Receiver on the grounds of (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) contracting debts provable in bankruptcy without having probable or reasonable ground of expectation of being able to pay them; and (3) contributing to the bankruptcy by rash and hazardous speculations. After hearing Mr. Douglas W. Money in support of the application, his Honour granted a discharge subject to judgment for £50.

W. T. Smith, electrical engineer, Victoria Street and Hampden Street, Bolton.—This case was mentioned at Bolton County Court, on December 17th, under the head of applications in bankruptcy. The application was to sanction a scheme of composition approved by creditors, at the rate of 5s. in the £. Part of the first instalment had been paid, but owing to certain circumstances, industrial unrest, and the moulders' strike, debtor was not in a position to pay the balance. Under ordinary circumstances the money would have come to hand, and applicant now asked for a short adjournment to get together the balance of the instalment. The application was not opposed, and the Judge agreed.

Electrically-Driven Mill Machinery.—At the twenty-ninth ordinary general meeting of shareholders of Messrs. Dorman, Long & Co., Ltd., it was announced that the motor supplying the driving power for the company's new steel plate mills was considered to be the largest in the world. The full-load capacity of the machine is given as 20,500 H.P. The armature alone weighs 120 tons.

LIGHTING AND POWER NOTES.

Arbroath.—Street Lighting.—In answer to a demand for improved street lighting, the T.C. has agreed to the reinstallation of electric light.

Aylesbury.—Loan.—The T.C. has applied for a loan of £54,491 for extensions to the electricity undertaking.

Barrow-in-Furness.—Waste Gas.—Mr. H. R. Burnett, electrical engineer to the Barrow Corporation, has been acting as hon. secretary and engineer to the local Joint Committee, whose provisional scheme embodied the use of waste gases from the iron-works blast furnaces. Mr. Burnett has considered the effect of the alterations made in the Electricity Bill in the House of Lords, and says that, so far as that district is concerned, the amendments will not necessitate any very material alteration in the scheme which is being prepared. The Bill, as amended, still provides for the setting-up of joint electricity authorities by the voluntary co-operation of local authorities and others interested, and, so far as that district is concerned, the principal difference will be that the generation of the supply will probably remain in the hands of the Barrow Corporation for the time being; however, there is little doubt that ultimately the generation will be undertaken by the joint electricity authority. The alternative to voluntary co-operation in many districts will be to have no supply of electricity for a considerable time to come, as there is little doubt that the Electricity Commissioners would refuse to sanction the setting up of small independent undertakings. The new clause which has been introduced provides for the constitution of the joint electricity authority on similar lines to the Provisional Committee which has already been appointed.

Beddington and Wallington.—Housing Scheme.—The U.D.C. has decided when it is possible to have E.L. installed in the new dwellings being erected. Energy will be supplied by the County of London E.S. Co.

Belfast.—Docks Supply.—The Harbour Board has been in communication with Messrs. Heyn & Co. relative to the provision of electricity at West York Dock in connection with certain appliances for discharging vessels. The Board approved a recommendation for laying cable.

Bellingham (Northumberland).—E.L. Scheme.—Owing to difficulty with regard to lighting, as the gas undertaking has been carried on for a considerable time at a loss, and shortly will be discontinued, it is proposed to light the area electrically, with power from Hareshaw Burn. Plant as a stand-by for emergencies will be installed.

Bradford.—Supply Restrictions.—Serious overloading of the city plant at certain hours has led to a warning from the Committee that, unless the use of power is restricted, it will be necessary to shut down the tramways and other undertakings to prevent a breakdown. The normal capacity of the plant was rated at 12,900 KW., but the load on one occasion recently reached 19,172 KW.

Chile.—New Cables.—A concession has been secured by the Compania General de Electricidad to lay underground cables in the City of Santiago for the purpose of supplying electricity.

Darwen.—Bulk Supply.—Application is to be made to the Lancashire E.P. Co. at Turton, for a supply of electricity, as the town plant is out of date and unable to cope with the demand.

Dublin.—Street Lighting.—The Lighting Committee has ordered that street lighting be continued all night up to the end of February. The system for some time past has been to extinguish most of the lights, gas and electric, except in main thoroughfares, at midnight.

Dunoon.—E.L. Scheme.—The lighting of the town by electricity is under the consideration of a company, and the water supply has been proved sufficient for the undertaking.

Continental.—Spain.—The municipal authorities of Ripoll (Province of Gerona) have invited tenders for the concession for the electric lighting of the town.

Sweden.—Among the new companies recently formed in connection with the utilisation of water power and the generation and distribution of electrical energy are the Borgholms Elektrisk Aktiebolag, Borgholm; and the Stara Harrie Kraft Aktiebolag, of Binneback.

Greece.—A scheme is being considered to light some 50 villages in the island of Syra with electricity, and orders for the plant will shortly be issued. Instant action on the spot is advisable for those desirous of competing for the business.

France.—La Société Normande d'Electricité is the name of a new company which has lately been formed in Paris, with a capital of £40,000, with the object of establishing electric generating stations in Normandy.

So far back as October 19th, the French Chamber of Deputies adopted a *projet de loi* for the establishment by the State of a H.T. electric network in the liberated regions of France. The cost of this undertaking is estimated at 135,000,000 fr., part of which will be supplied by yearly votes, and part by companies working independently or in association with the State. The plans contemplate (1) a H.T. distribution network serving the 25 principal towns of the regions in question; (2) serving Paris, Saint-Just,

Arras, and Pont-à-Vendin; and (3) the installation of a generating station at Hirson (Aisne). The network is to be carried out in sections, each being separately declared "of public utility," and each worked separately.

The Société des Forces Motrices de l'Arc has been established at Paris for the utilisation of the falls on the Arc River, and the erection of a generating station. Its capital is 2,000,000 fr.

Falkirk.—Loan.—The T.C. is to apply for powers to borrow £30,000 to extend the electricity works. There are at present 10 consumers awaiting connection, whose aggregate demand is equal to 400 kw., and extensions are in contemplation by existing consumers. A 1,500-kw. turbo-alternator is to be installed, and a second boiler in the existing works, together with coal and ash-handling plant. An additional H.T. main, 2,000 yards long, will be required.

Kidderminster.—Price Increase.—The E.L. Co. is to increase the charge for electricity from 6d. to 7d. per unit, on the understanding that an improved service is given and the works extended.

Londonderry.—The Lighting Committee of the Corporation recently received a letter from the managing director of the N. of Ireland Shipbuilding Co. complaining of delay in the completion of the additional electricity supply, and alleging that a new generating set in the power station had been burnt out owing to mishandling on the part of one of the principal Corporation officials. It was also stated that several important shipbuilding contracts had been lost to the city, due to the delay in completing the extensions. The Chairman of the Committee pointed out that the delay was due to labour troubles, which delayed the buildings for 13 or 14 weeks. Mr. Macrory, city electrical engineer, reported that every effort had been made to hasten the installation of the new plant. The breakdown of the new set occurred whilst it was in the contractor's hands, due to a constructional defect or to damp, and was of a trivial nature, being repaired within a week. The plant could not be put into service till the building contract was further advanced. With the exception of a stoppage due to water famine, a continuous supply had been given to the shipyard for seven years. A resolution was unanimously adopted declaring that the charges were unfounded, and expressing full confidence in Mr. Macrory.

Mansfield.—Electric Pumping.—The Water Committee has decided to erect a pump house and boosting plant, consisting of a set of three-throw pumps, capable of pumping 8,000 gallons per hour. The estimated cost, if electricity is used, is £760 plus 1s. 9d. per hour for energy; if a gas engine is used, £940, the estimated cost of gas to drive the pump being 1s. 2d. per hour. The Committee is asking the E.C. for terms upon which it would supply electricity.

Nigeria.—Water Power.—At the meeting of the Northern Nigeria (Bauchi) Tin Mines, Ltd., in London, last week, it was stated that the Kwall Falls power scheme, upon which the future of the company so much depended, was making progress. Messrs. Vickers had stated that the stream would produce from 1,000 to 1,500 H.P. Mr. Canning, who had just returned from the property, said that when the power plant was running, the company would be less dependent upon labour than most mines. The contract for the power installation was signed in January, and by the end of June one-third of the construction of the necessary camps and roads was complete and many other works begun. That was the first hydro-electric plant to be erected on the West Coast of Africa, and the Nigerian Government and others were keenly interested in it. The scheme would greatly decrease their working cost and increase their profit. Every effort was being made to complete the plant by next July, but the difficulty of getting the special plant completed was very considerable. There seemed every hope that next year would see the plant running, but all works were suffering from the aftermath of war, and dates were most difficult to give.

Peterborough.—Extensions.—The C.C. is to expend £40,000 on a scheme for developing and enlarging its electricity undertaking, involving a new H.T. distribution system.

Richmond-on-Tees.—E.L. Scheme.—The T.C. is to advertise its desire for the installation of an electric system for the town, with an intimation that the Council will encourage and facilitate by all available means schemes submitted by any existing or prospective company.

South Molton (Devon).—E.L. Scheme.—Mr. Stuart, electrical engineer, has reported to the T.C. on an electric light scheme for the town.

Swansea.—Wages.—Several applications for increased pay are before the Corporation from the men. The fitters are applying for an increase to £5 per week on a 47-hours' week; the charge engineers ask that their hours be reduced from 53 to 48 per week; and the wiremen and jointers are applying for an increase in their wages to £5 10s. per week.

Torquay.—Proposed Extensions.—A private conference was held recently to discuss the proposal for an extensive scheme of electrical supply for certain South Devon towns. The erection of a large generating station is contemplated at Torquay to take the place of the present station, which is inadequate and unsuitable, and other towns are asked to join in the enterprise. Among the towns it is proposed to serve are Teignmouth, Totnes, Buckfastleigh, Newton Abbot, Kingskerswell, and Dartmouth.

Twickenham.—Proposed Price Increase.—The E.S. Co. has applied to the B. of T. for an order to modify the charges for electricity as follows:—Twickenham, 91 hours, at the maximum demanded, 7d. per unit; a further quantity not exceeding 91 hours, at the maximum demand, 4d., and beyond 2d.; Teddington and Hampton, up to 20 units, 11s. 8d., and beyond, 7d.; Hampton Wick, 91 hours, 7d., and beyond, 3d.; Ham, 91 hours, 7d.; beyond, 3d.; or the option of 10s. up to 20 units, and 6d. beyond.

Walkden.—New Plant.—Messrs. E. Lane & Sons, cotton goods manufacturers, are having a power station built for the supply of energy to the Boatshed Mills. The Lancashire E.P. Co. has completed the erection of a sub-station in Walkden, and connections with the mains were made last week.

West Ham.—Breakdown.—Owing to a breakdown at the Corporation's station at Canning Town, on December 21st., most of the borough was in darkness for about half-an-hour. The plant had for some time been overloaded, and arrangements had been made for supplies from the L.C.C. and neighbouring authorities, so that the tramway services and some sections of street lighting were not affected.

Weymouth.—Proposed Price Increase.—The T.C. has applied to the B. of T. for an Order to increase the maximum charge for electricity from 8d. to 10d. per unit, and to advance the maximum charge per quarter from 13s. 4d. to 15s.

TRAMWAY AND RAILWAY NOTES.

Brazil.—Railway Electrification.—An Anglo-American financial group is considering a project for the electrification of a railway from Victoria, on the coast, to Diamantina, a distance of 100 miles inland.

Burnley.—Accident.—A B. of T. inspector held an inquiry on December 11th, into the tramcar accident at Harle Syke, resulting in four men and a boy being severely injured. A fitter stated that the car in question had a defect in the hand-brake, which he rectified, and he considered the car in good order when it left the shed. The driver, who had been with the department six years, said he could only account for the mishap by the fact that the automatic switch gave out, and the wheels then started slipping. He could not state the reason why the brakes failed. He was quite aware of the risk of using the electric brake and the hand brake together, and he did not do so. The conductor said it was quite a daily occurrence for the sanders to be blocked up with stones and tickets.

Dunoon.—Proposed Light Railway.—Failing private enterprise, the T.C. may build an electric railway between Sankbank and Innellan.

Heywood (Lancs.).—Wages.—An application from the Association of Tramway and Vehicle Workers, for the award of the Committee on Production of 4s. per week increased war bonus for tramway inspectors, has been acceded to.

Continental.—Spain.—The tramway employés at Madrid struck work on the 16th inst. The police and gendarmerie were obliged to intervene frequently and disperse parties of strikers.

France.—With a view to electrifying a further portion of its railway lines in the Departement des Basses-Pyrenées, the Compagnie du Midi has decided to develop the falls in the Upper Valley of the Ossau. The plans comprise the building of three hydro-electric works, situated at Artouste, Miégebat, and Hourat respectively, of a total capacity of 54,000 H.P.

The Société Versaillaise de Tramways has decided to employ on its network three-phase energy at 50 periods, instead of the single-phase at 60 periods which it now uses.

Owing to the failure of the supply, due to lack of coal, the cars on several sections of the Paris tramways stopped running on Saturday.

Trains have been held up in the Perpignan district owing to telegraph posts having been blown across the lines by a violent gale.

Italy.—Responding to the invitation of the Ministry of Industry, Trade and Labour, the Chamber of Commerce located at Rovereto has outlined the railway works advisable to be carried out by the State for the improvement of traffic in the Trentino, as follows:—First, the completion of the Valsugana network, with the Primolano-Trento branch line. Secondly, conversion into a normal line, with electric traction from Rovereto to Riva, of the existing steam tramway running between Mori, Arco, and Riva. Thirdly, construction of the electric tramway lines Lavis-Cembra-Cavalese-Moena, and Trento-Sarche-Tione, with branches between Sarche-Riva and Male-Fucine. Fourthly, favourable consideration of the plans for the projected Schio-Rovereto line; the proposed junctions at Tione-Pinzolo and Tione-Vestone-Brescia; the prolongation of the Cavalese-Moena line through the Fasse Valley; the junction proposed between Fucine and Edolo; the construction of a line from Peschiera to Lazise, Malcesine, and Riva; the linking-up of Brescia with Riva di Salo, and of Trento with Rovereto on the left bank of the Adige. In connection with the above schemes the Communal Council of Trentino has subsequently been discussing the ways and means of building a second electric generating station on the River Sarca, to produce some 10,000 kw.

Freshfield.—An electric workmen's train on the Liverpool-Southport line caught fire early on the morning of December 17th, when between Ainsdale and Freshfield. The flames were soon extinguished, and the train on reaching Freshfield was withdrawn.

Little Hulton.—Track Maintenance.—It is stated that if the B. of T. approves the application of the South Lancashire Tramways Co. to increase fares, the D.C. will require an additional grant for the maintenance of the roads occupied by the track. But it also asks that the company be required to provide and maintain 1d. stages.

Little Lever.—Extensions.—The U.D.C. has suggested that the tramway authorities of adjoining districts should link up so as to provide a through service from Bolton through Little Lever and on to Radcliffe. The proposal has been before the Bolton Tramways Committee.

London.—Central London Railway.—The Minister of Transport has extended until July, 1921, the time under the Central London Railway Act, 1914, for the completion of the enlargement of the tunnels, &c.

New Trains.—In connection with the efforts being made by the Metropolitan Railway Co. to give greater comfort to the travelling public, and to alleviate traffic congestion, a new type of train was on view for public inspection, at Baker Street Station, last week. The train consists of six coaches, and 100 more coaches of the same pattern are under construction. In each there are five swing doors on each side similar in pattern to those used in steam-driven trains. The seating accommodation has been increased from 268 to 292. The seats are arranged so as to leave the central gangways clear, and a number of brass rails fixed to the seat backs take the place of the familiar straps. The train is also fitted with an improved device for controlling the "trip" for actuating the brakes in emergency, and the driver has an automatic "window-wiper" to enable him to have a clear view in thick weather. Numerous glass wind screens extending from the backs of seats to the roof prevent draughts, and the heating and lighting have also been improved. The new train will be taken into use forthwith.

On the North London Railway, in the New Year, some additional trains in the early morning and in the afternoon will run to and from Richmond and Kew Bridge, and there will also be improved services between Willesden and Acton and Broad Street.

The Metropolitan District Railway Co. is applying to Parliament for powers to extend the Aldgate East Station.

North Riding.—Light Railway.—The Light Railway Commissioners have held an inquiry, and expressed themselves in favour of the proposals of Sir Robert Walker and the Trustees of the Land Hutton Estate, for the construction of a light railway having a 15 in. gauge, to serve a number of villages in Flaxton rural area, mainly for the transport of agricultural produce.

Surbiton.—Accident.—In a collision between two tramway cars last week, three passengers were slightly injured.

United States.—Fare Increase.—Since the war, the New York Underground Railway Companies have been compelled to pay 100 per cent. more for operating, and have increased employés' wages by 103 per cent. In consequence, the 2½d. fares will be shortly increased to 5d.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Although the Navy Department claims to have effected considerable improvement in the wireless service, its critics state that much unnecessary expense and confusion have been caused by the substitution in several stations of the Marconi "hook-up" in place of the Balsillie system originally installed. The Navy Department claims that this was necessary, but outside engineers are of opinion that the alterations were a means of disposing of surplus appliances from the Government workshops.—*Age.*

Norway.—The Stavanger wireless station in Norway has now been opened. Communication will be held with the Annapolis station at Washington and the Tuckerton station near Philadelphia. The station will be able to transmit 10,000 words daily; the rate will be Ore 90 per word.—*Economic Review.*

South America.—An "all-American" cable between Montevideo and Buenos Aires was opened to traffic on Saturday.

South Africa.—The number of telegraph offices increased from 1,703 to 1,738 in 1918, and the number of messages from 6,174,888 to 6,619 635. The number of telephone exchanges increased from 437 to 452, and the number of telephones from 36,846 to 38,396. Trunk communication was opened during the year between Port Elizabeth and East London. It has been decided to adopt automatic working at Cape Town, Pietermaritzburg, and Johannesburg.—*T. and T. Journal.*

Uruguay.—The National Council of Administration will shortly present a message to the Legislative Chambers asking that the Department of Wireless Telegraphy be authorised to contract for a loan of $200,000 (Uruguayan gold) from the Bank of the Republic, in order to carry out improvements and extensions in the wireless telegraphic services.—*Review of the River Plate.*

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Sydney.—January 28th. N.S.W. Government Railways and Tramways. One 1,250-kw., 50-cycle turbo-alternator.

February 18th. One electrically-controlled tower clock and four dials, for Sydney sub-station. Chief Electrical Engineer's Office, 61, Hunter Street, Sydney.

Perth, W.A. — February 10th. P.M.G.'s Department. 340 accumulators (schedule W.A.647.) (December 19th.)

Barnes.—January 20th. U.D.C. Electricity Department. Supply of water-tube boilers, economisers, draught plant, turbo-alternators, condensers, air and circulating pumps, transformers and rotary converters. (December 12th.)

Bedwellty.—December 29th. U.D.C. Supply and erection of a small sub-station equipment, and about 3,000 yd. of pole line. (December 19th.)

Bootle.—January 7th. Corporation. Wiring 34 houses under the housing scheme. (See this issue.)

Bradford.—January 28th. Corporation. Two electric battery locomotives. (See this issue.)

Cavan.—January 12th. Electric Light & Power Co. Suction gas engine and plant; alternative tender for duplicates, electric generator and motor booster; alternative tender for duplicate, generator, electric storage battery, D.C. switchboard. (See this issue.)

Chile.—March 15th. Comision de Puertos, Santiago. Electrical machinery (power and lighting) for the Port of Valparaiso. Comision de Puertos, Santiago, Chile. Copies of the specifications can be seen at the Chilean Legation, London, between 3 and 5 p.m.

Dundee. — January 23rd. Corporation. Electricity Department. Three 750-kw. converter sets; one 300 kw ditto; 11,000 v., E.H.T. switchboard; two 750-kw., D.C. control panels; one 300-kw. ditto. (December 19th.)

Govan (Glasgow).—December 30th. Clyde Navigation Trustees. Electrically-driven de-watering pumps for Nos. 1, 2 and 3 Graving Docks, Govan. W. Bridges & Co., Engineers 3, Salters Hall Court, London, E.C. 4.

Halifax.—January 5th. Electricity Department. Supply of stores (including lighting fittings and electrical accessories, cables, meters, &c.), from February 1st, 1920, to March 31st, 1921. (December 19th.)

London.—Islington.—January 28th. Electricity Committee. Stores, including cables, meters, electric lamps, &c., for 12 months. (December 19th.)

Fulham. — January 13th. Electricity Committee. Manufacture, delivery and laying, complete, duct, E.H.T. cable, &c., between the generating stations of Fulham and Hammersmith. (December 19th.)

Stepney. — January 22nd. Electricity Supply Committee. Two water-tube boilers, chimneys, economisers, &c., and one 5,000 kw. turbo-alternator, with condenser, accessories and switchgear. (December 19th.)

Manchester.—January 14th. Electricity Committee. One 2-ton electric lorry (specification No. 23); one 10/15-cwt. electric van (specification No. 24). (See this issue.)

December 29th. Electricity Committee. Three-phase, 6,600-volt. sub-station switchgear. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Paris.—Six kilometres, 6-conductor gutta-percha, lead-covered cable. Offers to M. le Directeur des Services du Dépôt Central du Matérial, 75, Boulevard, Brune, Paris.

Rhondda. — January 5th. U.D.C. Electricity Committee. Steel or wood poles and the completion of overhead lines. (December 19th.)

Sheffield. — January 2nd. Electric Supply Department. Supply and laying of six-core, E.H.T., split-conductor cable (contract No. 268). (December 12th.)

Spain.—January 25th. The Harbour Works Authorities at Alicante are inviting tenders for the supply of three electric cranes. Particulars may be obtained from, and tenders are to be sent to, the Junta de Obras del Puerto, Alicante.

Tynemouth. — January 12th. Electricity Department. Ten 250-K.V.A. transformers. (December 19th.)

CLOSED.

London.—L.C.C. Highways Committee. Laying stoneware ducts, repaving, &c., in connection with the construction of the new tramways from Lee Green to Eltham, and in East Hill, Wandsworth :—

G. I. Anderson		£8,346
J. Mowlem & Co., Ltd.	(recom.) ..	**8,522**
G. P. Trentham, Ltd...		10,295
J. G. White & Co., Ltd.		13,880

Equipment of additional cars with traction gear. The undermentioned tenders, which are the lowest received for certain portions of the apparatus and materials required, have been accepted :—

Brush Electrical Engineering Co., Ltd.	£1,030
A.B.C. Couplers, Ltd. (less 2½%)	1,494

Watford.—B. of G. E.L. installation for the nurses' quarters :—

J. W. Russell ..	(accepted) ..	**£36**
Connare & Co.	.. ..	37 10s.
Rogers & Gowlett	.. ..	39 10s.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—At Albemarle Street, Piccadilly, W. At 3 p.m. Lectures by Prof. W. H. Bragg, F.R.S.
Tuesday, December 31st. "What is Sound?"
Thursday, January 1st. "Sound & Music."
Saturday, January 3rd. "Sounds of the Country."

Junior Institution of Engineers.—Friday, January 2nd, 1920. At 39, Victoria Street, S.W. At 7.30 p.m. Lecturette on "Automatic Electric Weighing Machines as used by Machine Packers," by Mr. V. Sims.

NOTES.

Educational.—Speaking as chairman at the Crystal Palace School of Engineering recently, on the occasion of the award of certificates, Mr. H. E. Stilgoe, chief engineer of the Metropolitan Water Board and an old student of this school, told the students not to specialise. The great thing was to pay every attention to the opportunities of training, as such opportunities might not come later. Men gained experience every day, but they did not get the chances of study later. If they attempted to specialise they lost a thorough grounding in all things appertaining to civil engineering.—*Daily Telegraph.*

The Electricity Supply Bill.—The Bill, as amended in Committee, was considered in the House of Lords on Friday last. The power given to the Electricity Commissioners by Clause 3 to conduct experiments for the improvement of the methods of electric supply or of the utilisation of fuel was enlarged, on the motion of the Lord Chancellor, by adding "water power," which, he said, might be useful in connection with the inquiries of the Water Power Resources Committee.

The Report stage was agreed to. The Bill was afterwards read a third time, and passed.—*The Times.*

On Monday the Lords' amendments were considered by the Commons, and the Bill was passed, the Government declaring its firm intention of pressing the postponed clauses through early next session.

Electrical Workers' Wages.—The award was issued on Saturday in an arbitration claim heard by the Industrial Court for a further war wage advance of 15s. per week for workers employed in the electricity undertakings in the metropolitan area. The Court awarded to men aged 18 and over an advance of 5s. a week. The men concerned had already received war advances up 28s. 6d. a week, and, in addition, those aged 21 and over had been granted a bonus on earnings of 12½ per cent. in the case of time-workers, and 7½ per cent. piece-workers.

A similar claim has been made by the Electrical Trades Union and other Unions for an advance of wages for electrical workers on railways operating in the London district. The Court awarded an advance of 5s. a week to men aged 18 and over.

Inquiries.—Makers of a hand-lamp of aluminium alloy, marked "W.E.F.C.O.," are asked for.

The Physical Society's and Optical Society's Annual Exhibition.—This exhibition, which is to be held on January 7th and 8th, 1920, at the Imperial College of Science, South Kensington, will be open from 3 to 6 p.m., and from 7 to 10 p.m. Prof. F. J. Cheshire, C.B.E., will give a discourse on "Some Polarisation Experiments," at 8 p.m. on January 7th, and at 4 p.m. on January 8th ; and Prof. A. O. Rankine, D.Sc., will give a discourse on "The Use of Light in the Transmission and Reproduction of Speech," at 4 p.m. on January 7th, and at 8 p.m. on January 8th. The lectures will be illustrated by experiments. Some 40 firms will be exhibiting, and there will also be certain experimental demonstrations.

We understand that invitations have been given to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Faraday Society, the Wireless Society of London, and the Röntgen Society. Admission in all cases will be by ticket only, and therefore members of the societies just mentioned (including also the Physical and Optical Societies), desiring to attend the exhibition should apply to the secretary of the society to which they belong. Others interested should apply direct to the Secretary of the Physical Society, National Physical Laboratory, Teddington, S.W.

The Battl-Wallahs' Society.—The Committee announces another of its informal events for Wednesday, January 7th. Tickets for the meal and entertainment 5s. 6d., obtainable from Mr. A. J. Greenly, 37-38, Strand, W.C.

Appointments Vacant.—Assistant telegraph engineer (£363 + £75 + 30 per cent.), for the Federated Malay States Government Posts and Telegraphs ; teacher of electrical engineering and physics (£225 to £315) for the L.C.C. School of Engineering and Navigation, Poplar. See our advertisement pages to-day.

Fatality.—A youth named R. A. Black was accidentally killed at Messrs. Gray's Shipyard, Pallion, Sunderland, on the 16th inst. He was jointing a wire when a 240-volt current was, without warning, suddenly turned on while he had the wire still in his hands. He was killed instantly. At the inquest, a youth named Marshall, who was working with deceased, said he was sent to attend to fuses near the switch which controlled the current for the wire where Black was working. He did not turn the switch on. The Coroner, after hearing other evidence, said there was no doubt that someone had turned on the switch, but, apparently, he was not man enough to come forward. A verdict of "Accidental death" was returned.

A Whitley Council for London. — A Greater London Electrical Conference was held on Monday for the purpose of setting up a Greater London Area District Council under the National Joint Industrial Council of the Electrical Industry. The chairman, Mr. C. P. Sparks, explained that the new District Council would take the place of the Joint Committee that had been in existence for 18 months, and had done very good work. It would secure joint action between employers and workpeople for safeguarding the industry. There would be an equal number of representatives of labour and of the employers. A resolution was unanimously carried that a District Council should be set up for the Greater London area.—*Westminster Gazette.*

Automatic Sub-stations.—The Pacific Electric Railway Co. has recently opened a new automatic sub-station at Torrance, U.S.A., which has proved very successful. The station is started up by a predetermined voltage drop for two seconds in the trolley supply, the operation taking from 30 to 40 seconds. When the normal voltage is restored the rotary is automatically shut down within a period, which can be adjusted, of from 3 to 20 minutes. By means of a thermostat a sustained overload will stop the rotary, which starts up again when the thermostat cools down. The rotary starting switch cannot close until all but the pilot brushes are raised, and the brushes will not lower until the D.C. voltage of the right polarity and strength has been built up. In the case of wrong polarity the field is automatically reversed. The D.C. contactors which connect the rotary to the line cannot close until all the brushes are down on the commutator. Overheating is guarded against by thermostats placed in each bearing. The main D.C. connector has a relay which opens when the contactor has made three successive attempts to close on a short circuit or grounded line. The opening of this relay shuts the station down by actuating the automatic control circuit.

Motor-car Control by Wireless. — Dr. A. M. Low delivered an interesting lecture, under the auspices of the Southend and District Automobile Club, at Southend, last week on "Horrors of Motor-cars." Its leading feature was the demonstration for the first time of a special apparatus for controlling a car by means of wireless. The lecturer explained that the cost of running would be prohibitive, except to Government departments, and he saw little hope of the system being perfected for many years to come. That system of transmitting power was, however, bound to come. An interesting section of the lecture dealt with methods of examining moving parts of cars by means of a synchronised kinematograph, some particulars of which were given in our "New Devices" columns some months ago. The lecturer showed by a special film the movements of different parts of a car engine, which method should prove of value to designers.

Safety First.—A chapter on "Accident Prevention and Safety First" is contributed by Mr. G. Bellhouse to the annual report for 1918 of H.M. Chief Inspector of Factories, in which he reports that during the year 1,579 fatal cases, 53,491 accidents due to machinery, and 108,663 non-machinery cases were notified. He considers that if a real reduction is to take place, it can be effected only by the joint effort of employers and workers in each individual trade and factory. The remedy is in a wide extension of the system of safety committees, which have been attended by much success in the cases where they have been tried. The essential feature of the constitution of the committees is that there shall be joint representation of the management and of the workers. The representation need not necessarily be equal, but there are advantages in making it so; in particular, questions before the committee can be decided by a majority vote, whereas without it decisions can only be reached by agreement. The committee should publish an account of each accident investigated and of the causes which led to it. Experience shows that the publicity so obtained is of immense educational value, and has a marked effect on the workers whose accidents have resulted from carelessness and negligence. It has also the further important duty of keeping the question of "safety" prominently before the workpeople.

Institution and Lecture Notes.—Institution of Electrical Engineers.—Mr. J. Lythgoe delivered a lecture, on Dec. 15th, at the Armstrong College, Newcastle-on-Tyne, to the members of the North-Eastern Centre, upon "Electrical Developments at Christchurch, New Zealand." Mr. W. Cross, district chairman, was in the chair. Mr. Lythgoe referred to the proposed scheme for the North Island, of which the transmission lines would be 1,421 route-miles long, and there would be 29 primary sub-stations. The transmission pressures were 100,000, 20,000, 10,500, and 3,000 volts. The standard voltage adopted was 400 volts three-phase and 230 volts single-phase. The lecturer drew attention to the great value and possibilities of water power in New Zealand, and then proceeded to speak of the electrical undertaking which supplied Christchurch and the neighbouring district with energy. In Christchurch there were 170 miles of streets and 2,000 street lamps in series varying in candle-power from 100 to 1,000, at 6·6 amperes. The growth of consumers and of load had, despite fluctuations, been steady from year to year, and the weekly load factor last year was 58 per cent. They were now preparing to push electrical cooking, and they were prepared to advance loans to consumers for ovens, &c., repayable in two years, at 6 per cent. They had also recently built a municipal garage for electric vehicles, which were becoming increasing popular, probably because motor spirit was dear and electrical energy was cheap. The garage was constructed to hold 60 cars, and before he left they had 38 in it, and good prospects. Their terms for charging and maintaining a half-ton Walker electric wagon were £40 per annum; for a one-ton vehicle, £45; and for a five-ton one, £85.

Junior Institution of Engineers.—In his presidential address to the Midland Section on December 2nd, Prof. F. W. Burstall dealt with "The Professional Status of the Engineer." Regarding the position of the engineer in a civilised community as comparable only with the position occupied by the physician and surgeon, he outlined the development of the older profession of medicine, pointing out that the protection of the public demanded that Parliament should take cognisance of the training and registration of the medical man, and it was for this reason that at present the profession of medicine and surgery was a more remunerative and respectable one than that of engineering. He doubted whether either the knowledge or the intellectual capacity of the average medical man was so high as that of the average professional engineer, but the doctor had the great merit of being a member of a powerful and close corporation whose powers and duties were laid down by Acts of Parliament, and the conduct of his professional duties was watched over by a body whose duty it was to exact a high standard of professional conduct. It was only within the last 70 years that the immense importance of engineering skill to a civilised community had been fully realised, and the demand for engineers came with such rapidity as to prevent the organisation of suitable means for training young men. To-day, however, the importance of highly-skilled engineering men could hardly be exaggerated. The difficulty was, however, to organise any such body as that which looked after the interests of medicine, the reason being that there was a very much greater number of types of mind required for engineering than for medicine. Without some attempt at such an organisation, it was quite certain that the engineer would never rank as highly in the estimation of the general public as if he were one of an organised and disciplined army. In the future, all engineers would receive a scientific education before they entered upon the commercial and manufacturing side of their profession. It would seem, considering the great responsibility of the engineer, that he would be a man held in high esteem, and put into positions of responsibility. Unfortunately this was not the case; this was largely due to the fact that our governing classes had been almost wholly drawn from the public schools and the older Universities. Their studies had been of a literary and humanistic kind, and most of them had little knowledge, and no sympathy for scientific power. Another reason why the engineer was not more powerful, was that he was an isolated individual. He was not a member of a powerful corporation such as that of medicine; he was not forced to qualify in his profession like the solicitor and barrister. The only method that would overcome these difficulties, was the formation of some corporation which would insist upon a standard of qualifications for its members, which would be cognisant of the behaviour of its members in professional matters, and which would lay down rules with regard to the remuneration which its members should accept; in other words, that the scientific members of the engineering profession should form a Trade Union of a similar type to that of the medical profession.

Barrow and District Association of Engineers.—At a general meeting of the Association, on December 12th, Mr. Frank W. Skinner, A.M.I.E.E., gave a lecture on "Electric-Arc Welding." The first part of his paper dealt with the characteristics of arcs when either carbon or metal electrodes were employed, and the speaker said that, owing to these characteristics, it was necessary to provide a voltage across the arc which would approximately vary in direct proportion to the current. The various means that were adopted to secure this were described, and the inefficiency of the usual method of introducing a resistance in series with the arc was emphasised. Mr. Skinner showed that a great increase of electrical efficiency could be obtained by the use of special machines having inverse compound-wound systems. The employment of a Daysohm magnetic clutch also tended to greater efficiency. The speaker was of the opinion that, except in special cases, covered electrodes producing a liquid flux were inferior to those supplying a gaseous flux, on account of the greater speed in welding obtainable by the use of the latter type, as well as the risk of slag inclusions in the weld which attended the use of liquid flux.

The second part of the paper was devoted to comparative costs and strengths of welded joints, and to the progress made in this direction. The lecture was illustrated by means of lantern slides.

Edinburgh Electrical Society.—The third general meeting of this Society was held at the Philosophical Institution, Edinburgh, on December 10th, when a paper on "The Repair and Maintenance of A.C. and D.C. Machines" was read by Mr. James Walker, of Messrs. Brunton, Musselburgh. The author exhibited a large number of lantern slides illustrating machines at various stages of repair, and showing some of his own devices for overcoming common defects and troubles met with on motors and controllers. There was a good discussion, and many new members were enrolled.

Association of Mining Electrical Engineers.—The members of the West of Scotland Branch recently visited the Dalmarnock power station, which is now nearing completion. After the visit a social gathering was held at the Trades House.

Society of Engineers.—The Council has awarded the President's Gold Medal to Mr. Alfred S. E. Ackermann, for his paper on "Experiments with Clay in Its Relation to Piles"; and the Bessemer Premier to Mr. E. O. Bannister for his paper on "Heat Treatment of Steel," value £5 5s.

Bolton Engineers' Association.—Members have been addressed by Mr. Sam Bury, on "Central Electric Station Supply *v.* Privately-Owned Plant." Mr. Bury showed that in some instances economy would be obtained from central station supply, but also pointed out that there was something to be said on behalf of privately-owned reciprocating engine plant.

Society of Technical Engineers.—At a meeting of the Woolwich Branch on December 12th, at which Dr. Crowley took the chair, an address was given on "The Proper Position of the Engineer in Industrial and Political Circles" by Mr. E. C. de Segundo, A.M.Inst.C.E. In his remarks from the chair, Dr. Crowley stated that, "in his opinion, engineers should take a keen interest in political problems, and do all in their power to educate those subordinate to them in the duties of citizenship and the necessity for increased productivity in the industry. This was one of the objects for which the Society of Technical Engineers was founded, and was just as important as the improvement of the engineer's status, which should be accomplished by legitimate means."

Plant Life.—The Bose Research Institute, at Calcutta, of which Sir Jagadis Chandra Bose is director and founder, was dedicated to the nation in November, 1917. As far as accommodation will permit, its facilities are available to workers of all countries. The Institute includes an experimental station at Sijberea, on the Ganges, and the research station, Glen Eden, at Darjeeling. Here, as at Calcutta, are carried on investigations aiming at the discovery of the laws of growth of plants. Sir Jagadis's investigations into living plant life, some of which he demonstrated at the India Office on December 16th, have established remarkable similarities in plant and in human life. Indeed, plants have been shown to possess a wider range of sensibility than human beings. The latter are unable to perceive signals through space, but Sir Jagadis has been successful in making the plant itself record the message received through wireless signalling. One experiment consisted in placing a leaf picked from a pot plant of celamen on the magnetic needle of the crescograph, one of Sir Jagadis's own inventions. From the mirror attached to the needle a spot of light appeared at once on the screen, and moved backwards and forwards across the latter at the rate of 10 ft. in 12 seconds. The actual rate of the plant's pulsation was 100,000th part of an inch per second. When the leaf was stimulated with an electric current the pulsations and the spot of light were quickened. "There is nothing in the animal which has not been forestalled in the plant," said the lecturer. "When a plant is placed in unhappy conditions, as in a bath of hot water, the time comes when it struggles and dies, and its struggles are the same as in the animal."

The I.E.E. Wiring Rules.—The Council of the Institution of Electrical Engineers has approved the following recommendation of the Wiring Rules Committee:—

"That Wiring Rule 39 be amended to read as follows:—

"39. Except for wiring fittings, the cross-sectional area (Table, Col. 2) of any copper conductor must not be less than 0·0015 sq. in. (1/·044 in.). The cross-sectional area of fittings wires must not be less than 0·0010 sq. in. (1/·036 in.)."

The matter is one of importance in view of the introduction of the new standard sizes, and the question has been raised in correspondence with the Institution and in the Press.

A complete revision of the Wiring Rules is in hand, and the Committee will be glad to receive suggestions (in the form of specific amendments) for consideration during the revision. Suggestions should be addressed to the Secretary of the Institution, 1, Albemarle Street, London, W.1. Many valuable suggestions have already been received.

Coal Rebate.—A committee, consisting of Mr. Roger T. Smith, President I.E.E. (chairman), and representatives of The Incorporated Municipal Electrical Association, The Incorporated Association of Electric Power Companies, The Conference of Chief Officials of London Electric Supply Companies, and The Provincial Electric Supply Committee of the United Kingdom, has had several interviews with the Coal Controller, and has drawn up a memorandum to show how the reduction to be made to electricity consumers to correspond with the 10s. reduction in the price of coal is to be carried out. A number of meetings have been held. It is hoped that the memorandum will be available for distribution to the various electricity supply undertakings immediately after the Christmas holidays.

Christmas at St. George's Hall.—In his Yuletide holiday programme at St. George's Hall, Langham Place, Mr. Nevil Maskelyne gives a place to an electrical display by "X, the Unknown," who, among other achievements, manufactures ozone, and, with the aid of an imposing display of electrical apparatus, passes current at a pressure said to be 2½ million volts through the body of a lady, lights cigarettes from a teaspoon placed on her tongue, and performs other spectacular experiments familiar to workers with high-frequency currents. Mr. Sivori Levey is present with his musical merrymakers "The Smilers," and Mr. Oswald Williams performs new magical experiments.

Stalybridge Electricity Supply.—A serious position has arisen owing to a dispute with the shift engineers at the electric generating station of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board. Less than a dozen men are concerned in the dispute, which is understood to have arisen over an application for an advance in wages which the men made in October last. This the Generating Station Committee agreed to, but the men are now asking that the advance should come into operation as from February or March last, as was done in the case of electrical engineers in the employ of London companies. The committee has offered to go to arbitration on the matter, but this the men will not accept, and they have resigned, with the result that the supply to mills, &c., has been greatly curtailed.

As we go to press we have received from Mr. W. Arthur Jones, A.M.I.E.E., general secretary of the Electrical Power Engineers' Association, the following communication:—

May I be allowed the hospitality of your columns to refer to the statements published by Mr. R. Blackmore, engineer-in-chief to the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, upon the causes of the present failure of the above supply, and to correct some of the inaccuracies contained therein.

Mr. Blackmore states that the interruption has been caused by the resignations of the shift engineers owing to differences on the question of wages. Whilst this is one of the differences, it is not the only one, neither is it the cause of the present trouble. It is, however, as a contributory factor, a matter upon which both sides should be heard.

The Electrical Power Engineers' Association in October, 1918, made a claim upon *all* electricity supply undertakings in the United Kingdom for certain increases in salary. After negotiations with the Standing Conference of Electricity Supply Associations—the then only national body representing employers in the electricity supply industry—the claim was, on the advice of the Ministry of Labour, referred to arbitration. The Ministry of Labour further supported this advice by recommending all undertakings to agree to arbitration. The Stalybridge undertaking, of which Mr. Blackmore is chief engineer, did *not* act upon the advice given by the Ministry of Labour.

The result of the arbitration was to give the Association all that it asked for, thus indicating the reasonableness of the claim made.

The Stalybridge Joint Board paid to the employés concerned certain increases under this award, but owing to the method adopted by the Board, such increases were not in accordance with the terms of the award.

We have since May last endeavoured to get from Mr. Blackmore some satisfaction upon this matter, but without success; as a consequence the aid of the Ministry of Labour has been invoked to settle by arbitration. Mr. Blackmore will only consent to this procedure if other matters which are not connected with this question are also referred to arbitration. To this the employés concerned will not assent, and after examination of all the circumstances, this Association has agreed to this decision.

These other matters relate to the conditions of employment of staff engineers at Stalybridge, and we say, without fear of contradiction, that such conditions are without parallel in the United Kingdom. Stalybridge as a generating station is considerably above the average size, yet the amount of assistance given to the shift engineers is far less than is usually provided in a station of half the capacity. The engineers at Stalybridge are paid by the hour, and during periods of sickness their "salary" is stopped, although the other engineers have to work extra time to carry out the necessary duties. During 1918 the excessive overtime that had to be worked by the shift engineers to obtain their "holidays" caused each of them to be laid up for certain periods. In June, 1919, these engineers desired to prevent a repetition of this, and requested Mr. Blackmore to provide extra assistance. Mr. Blackmore's reply was that "if any engineer is not of sufficiently robust health to carry out his duties properly, I shall be pleased to release him from further duty if he will send in his resignation."

The engineers at Stalybridge have taken this advice. They have been unable, either through their own efforts or by the aid of this Association to secure a change in these conditions, and so they have been compelled to resign their positions, rather than prejudice their health and prospects by remaining. We, as an association, have investigated this matter, and are recommending all our members not to accept any post at Stalybridge under the present conditions.

Mr. Blackmore suggests that he is willing to arbitrate upon this matter. This is something. Hitherto our correspondence with Mr. Blackmore has been notable for the curt nature of his replies, and the lack of any indication of a willingness to negotiate upon the matters raised. We cannot agree to arbitrate upon this matter until Mr. Blackmore, or more properly the Joint Board, makes some proposal upon the matter at issue, so that the arbitrator can adjudicate. We have had no proposals from Mr. Blackmore, neither has there been any conference between Mr. Blackmore and the officials of this Association.

In conclusion, may I point out that eight engineers are affected by this dispute. These engineers resigned their positions in accordance with the terms of their engagement; five men gave 14 days' notice, and three men gave seven days' notice. Your readers will appreciate that there is nothing of the nature of a "lightning strike" in connection with this dispute, and further, that the management had ample warning of what was likely to happen.

The sole cause of the present trouble is the irreconcilable attitude displayed by the engineer-in-chief, but the responsibility must also be shared by the Joint Board, who, as owners of the undertaking, do not appear to have realised their responsibilities. We suggest that the Joint Board should assert their authority to settle this dispute, so that the great loss to the community now in operation may be discontinued.—W. ARTHUR JONES.

The Training of Ex-service Men.—The receipt of applications for training under the training grants scheme for higher education and training of ex-officers and men of similar educational qualifications will be closed as follows: Applicants who were demobilised before October 1st last must lodge their applications on or before December 31st next. Applicants demobilised on or after October 1st last must lodge their applications within three months of demobilisation, and in any case not later than June 30th, 1920. These date limits will apply to the higher Government training grants scheme as administered by the Appointments Department of the Ministry of Labour, the Educational Departments of England, Scotland, and Ireland, and the Boards of Agriculture.—*Daily Telegraph.*

Secret Telephony.—A note on the above subject was contributed by Mr. E. Poirson to the French Academy of Sciences in July last. If in a telephone circuit periodic interruptions are set up of equal duration to those of the non-interruptions, the change in the voice no longer takes place above 2,000 interruptions per second. The shorter the period of interruption, the less the voice is altered. If the current is reversed with a commutator, the spoken word becomes incomprehensible; but becomes intelligible again when the current is commutated simultaneously in both stations. It is only necessary to effect synchronism between the reversing and rectifying gear. These conditions are satisfied in the cryptoform which is used for secret telephony, and which has been elaborated at the laboratories of the "Radiotélégraphie Militaire."—*Technical Review.*

Tight-joint Electric Welding.—Thomas E. Murray, Junr., of Brooklyn, N.Y., claims in two recently granted patents, important improvements in electric welding. Electrically-welded joints possessing a strength equal to that of the integral mass of the same material of like cross-sectional area can, he claims, be produced by subjecting the bodies to be welded to a current of a very high ampere strength for a very short time. For small areas a current of about 5,000 amperes is used. The duration of this large current should be about one second for an area of 5 sq. in., and from two to three seconds for an area of 10 sq. in. To insure a good weld, all that is necessary is to increase the strength of the current until perfect union is effected.—*Technical Review.*

Wireless Telegraphy.—The theory and use of wireless direction-finding apparatus is considered by Capt. A. S. Blatterman, U.S. Army, in an important paper printed in the *Journal* of the Franklin Institute. In 1917 and 1918 an investigation was carried out in the U.S. wireless laboratories to determine the most efficient shape of coil to receive signals directly which are sometimes heard when the antenna is disconnected from the apparatus. An investigation was also made of the most efficient shape of coil for direction finding, as the loudness of the signals varies with the position of the coil. Elementary theory would indicate that the coil would be more effective the larger its cross section and the greater its time constant. Further, it would appear that the loudness of the signals was inversely proportional to the square of the wave length. This, however, is not the case. The experiments recorded in this paper prove that there is a certain size of coil which gives the best results for a given wave-length. This was traced to the fact that the resistance of the coil varies with the wave-length. For very long wave-lengths the resistance has its ordinary value. As the wave-length is shortened, and, therefore, as the frequency is increased, the resistance increases slowly until it is two or three times its ordinary value, and it then increases with great rapidity. This effect makes the reception bad at high frequencies. There is, therefore, a certain sized coil which produces the best effects. The results of the experiments described prove this conclusively. A thorough investigation was also made of the directional characteristics of this type of receiver, and many curious properties depending on its height above the ground were discovered. Using a properly constructed coil in an ordinary room and a seven-stage amplifier, the signals issued by all the high-power European stations could easily be heard.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—After an animated discussion by the Blackburn Committee on the question of the salary of the electrical engineer, MR. P. P. WHEELWRIGHT, a recommendation to the Council to increase the salary from £800 to £1,000 a year was carried by a majority of one.

MR. G. C. MILNES, manager of the Lancaster Corporation electricity undertaking, has had his salary increased to £500, but will not devote any time to the tramways after February.

Southampton T.C. has appointed MR. J. BRIERLEY, traffic superintendent of the Rhondda Valley Tramways, as tramway traffic manager at a salary of £300 a year.

On Saturday, December 13th, MR. H. J. DEAN, A.M.I.E.E., district mains engineer, was presented with a silver stop watch and an oak biscuit barrel by Mr. E. Cross, the engineer and general manager, on behalf of the staff and workmen of the Rotherham Corporation Electricity Department, on his leaving the Department to commence business as an electrical and mechanical engineer in Rotherham.

MR. A. FODEN has resigned his position as engineer-in-charge with the Trafford Power & Light Supply Co., Ltd., Trafford Park, to take up a post on the staff of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park.

General.—*The Times* states that COLONEL SIR ANDREW M. J. OGILVIE, K.B.E., C.B., R.E., Joint Second Secretary of the Post Office since 1914, will retire from his official duties at the end of the month. He has been concerned chiefly with the work of the telephone and telegraph services. He took a prominent part in the arbitration on the transfer of the National Telephone Company's system to the Post Office in 1911. In addition to his Post Office appointment, Sir Andrew was made Director of Army Signals (Home Defence) in 1914, and during the war he was largely occupied in arranging for the provision of telephonic and telegraphic communications for the Forces in Great Britain, including anti-aircraft defence lines and air raid warnings. He also arranged for the Post Office to supply telegraph and telephone stores for the Army Signal Service of all the forces overseas.

The Times understands that Mr. GRANT ROBERTSON, of All Soul's College, Oxford, is to be appointed Principal of Birmingham University in succession to Sir Oliver Lodge, resigned.

The Morning Post says that Prof. RÖNTGEN, the discoverer of the X-rays, who is 75, is resigning from his post as lecturer at Munich University and as Director of the Physical Institute.

MR. C. SYLVESTER, A.M.I.E.E., A.M.I.M.E., of Coventry, sails on January 5th to take up an appointment as chief electrical engineer to the *Jamaica Times*, Ltd., Jamaica, British West Indies.

It is announced that SIR HENRY BABINGTON SMITH has been elected a director of the British Trade Corporation, and has been appointed deputy-governor.

ALDERMAN WM. THOMPSON has resigned the chairmanship of Blackburn Electricity and Tramways Committee after 25 years' presidency. He is 85 years of age.

MR. H. GORDON WRIGHT, Secretary with the Edinburgh Corporation Electricity Supply Department (and chairman of the Scottish Division of the Electricity Supply Commercial Association), was on Saturday presented with a case of gold-mounted pipes by the Clerical Staff of the Electricity Department, on the occasion of his leaving to take up a responsible position abroad.

Obituary. — The interment of the late MR. WM. CONNER, elder son of Mr. James Conner, O.B.E., general works manager of Messrs. Dick, Kerr & Co.'s Works at Preston, was attended by Mr. W. Rutherford, joint managing director, along with Mr. O. T. Gibb and other representatives from the Kilmarnock Works, the Manchester office, and members of the Preston staff and employés. Wreaths were sent by the shop foremen, shop stewards, and employés connected with Dick, Kerr's Works, as well as from other works' staffs.

MR. J. HARTLEY WICKSTEED.—The death took place at Leeds, on December 16th, of Mr. J. Hartley Wicksteed, chairman of the firm of Joshua Buckton & Co., Ltd., engineers and tool makers, Leeds. He was the president of the Association of Yorkshire Students of the Institution of Civil Engineers in 1905, and two years previously was also president of the Institution of Mechanical Engineers when it met in Leeds.

Will.—The late MR. F. A. BEVAN, the banker, who was chairman of the Anglo-American Telegraph Co., and a director of the Eastern Extension, &c., Telegraph Co., left £410,879 gross and £315,061 net personalty.

NEW COMPANIES REGISTERED.

Engineering Employment Bureau, Ltd. (161,570).—Private company. Registered December 12th. Capital, £5,000 in £1 shares. To take over the business carried on at 234, Strand, W.C., as the "Engineering and Commercial Employment Bureau." The subscribers (each with one share) are: A. E. Whitehead, 24, The Drive, Walthamstow, E.17, superintendent of labour; W. A. Willmott, 114, Holmleigh Road, Stamford Hill, works manager; R. S. Pearce, 7, Sedgeford Road, Shepherd's Bush, W., labour superintendent; W. Sheriff, 8, The Promenade, Palmers Green, N., engineer. The first directors are: F. J. West and P. Morris (both permanent) and A. E. Whitehead, W. A. Willmott, R. S. Pearce, W. Sheriff, and A. E. Flackfield. Registered office: 234, Strand, W.C.

Premier Electric Welding Co. (Newcastle), Ltd. (161,602).—Private company. Registered December 12th. Capital, £60,000 in £1 shares. To carry on the business of welders of metals and other substances by electrical, oxy-acetylene or other process, marine, electrical and general engineers, ship builders and repairers, &c. The subscribers (each with one share) are: Capt. J. G. de O. Coke, R.N., Bank Buildings, St. James' Street, S.W.; A. L. Haggerty, Bank Buildings, St. James' Street, S.W. The subscribers are to appoint the first directors. Solicitors: Bircham & Co., 46, Parliament Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Splitdorf Electrical Co. of London, Ltd.—Satisfaction registered October 31st, 1919, to the extent of £5,000, of charge for £15,000, registered October 11th, 1919.

CITY NOTES.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.

At the annual meeting, held on Thursday last week, at the offices, 106, Cannon Street, E.C., Major Leonard Darwin said it would be seen that the board had been able not only to provide an ample reserve against excess profits duty and income tax, but also to add about £10,000 to the carry forward, which now stood at just over £100,000. That was not at all an unsatisfactory position considering that the year in question, with the exception of the first six weeks, was one of transition from war work to peace work. Last year he touched on the difficulties that lay before them in that transition period. Those of their home competitors who did less war work than themselves—nearly 95 per cent. of their work was war work—had been able to establish themselves in their home markets, while neutral countries had reaped a similar advantage in their foreign markets. To take only one, though a very important, part of their output in peace time, they had practically to sacrifice their motor and cycle trade in order to turn out the very large number of aeroplane wheels and tires which were required of them. They made exhaustive experiments at their own expense with the view of producing the types of wheels and tires best suited for aeroplanes, and to withstand the various shocks, strains, and conditions to which they were subjected. They anticipated the numbers required, which would not otherwise have been supplied in the necessary quantities, nor by the time they were wanted, and they ended by fitting wheels and tires according to the designs they had perfected, to practically every aeroplane manufactured in this country. As a proof of the satisfaction given by those designs, he might mention that they were being considered by the American Government as the standards for their machines. That was a great success for their designing and engineering staffs, but the greater the success the more difficult was the position in which they found themselves at the cessation of hostilities. After devoting so much time and material to increasing the output, and at the very height of their production, orders from the Government suddenly ceased, and the numbers required weekly dropped to a fortieth part of the war demand. Aeroplane tire machinery lay idle, and their motor and cycle tire plant had to be restored to its pre-war efficiency. He said at the last general meeting that the period of reconstruction which lay before them gave rise to no little anxiety, and that the results of the year might well prove disappointing. He thought it was satisfactory to have passed through the ordeal as well as they had done. Of course, their difficulties were not over yet. The war and after-war conditions had had the effect of advancing prices of labour, and, generally speaking, of all materials, by a very considerable percentage, and there was no indication at present how long such a condition was likely to last. At the present time, compared with pre-war prices, coal had advanced nearly 200 per cent., cotton (of which they were large users) 350 per cent., and other materials (with the exception of rubber) in somewhat similar proportions. New machinery, tools and appliances, and the cost of repairs and maintenance of plant, had advanced 150 per cent., and building, as shown by their Burton works, might be taken to have advanced 200 per cent. in cost. Added to that, the average weekly earnings of the workers, both male and female, had advanced by approximately 100 per cent., and that notwithstanding that the working hours in the factory had been reduced from 59 to 47 per week. Those greatly increased costs would shortly involve the raising of fresh capital, and the question was now engaging the attention of the directors. In France, in spite of the difficulties arising out of the labour unrest, added to the high price of coal on the Continent, and, indeed, the difficulty of getting coal at any price, their Persan works had had a satisfactory year, and the small factory in Toulouse was proving a good investment. Their foreign branches had also done well, although they had been hampered by their inability to turn out all the goods for which they asked. There was one other matter connected with the past history of the company to which he wished to allude. Since the war began he had on more than one occasion said that they had been doing work for the French Government, but no

gave no details. Early in the war they were employed in diverting the German Emden-Teneriffe cable into St. Nazaire, and in making several repairs to French Government cables; dangerous work which ended more than two years afterwards with the sinking of their ship and the accompanying French man-of-war in Funchal Harbour, Madeira, by a German submarine. Far the most important work accomplished by the *Dacia*, under the supervision of submarine cable engineers, Mr. Crawford and Mr. Robinson successively, was the diversion of the rest of the German Emden-Teneriffe cable so as to connect Brest with Casablanca, in Morocco, and the diversion of the German Teneriffe-Monrovia cable so as to connect Morocco with Senegal. The Emden-Teneriffe cable was first cut off Brest, a length picked up and relaid into Brest. The same operation on a larger scale was then performed off Casablanca, with the result that after the necessary connections had been made, this second portion of the German Emden-Teneriffe cable was converted into a French Brest-Casablanca cable. Similar work was carried out on the German Teneriffe-Monrovia cable, thus extending the French cable from Casablanca to Dakar in Senegal. Their cable engineers, Mr. Crawford and Mr. Robinson, after fully considering the difficulties, held that those were possible operations; there were no signs that any other English expert, whether governmental or in private employment, shared in this view; whilst the electrical advisers to the French Government declared the scheme to be impracticable owing to the depth in which the cable lay. Imagine fishing for a cable in pitch darkness—not that any light at the bottom could have made matters easier—the cable lying about as far below the ship as was the Tower of London from Buckingham Palace; imagine trying to cut the cable in these circumstances in the hope of being able to haul up one of the two ends thus set free, to the surface; imagine pulling it up vertically through these nearly three miles of water, then steaming away whilst continuing to drag up the cable from the bottom, coiling it up on board without any kinks or unperceived injuries, and finally relaying it exactly where required; imagine all this, and scepticism as to the possibility of success became more than excusable. If their information was correct, that remarkable performance was absolutely unique in the history of submarine cable enterprise, and that whether they looked to the length of the cable lifted, 1,200 miles, or to the average depth of the water in which it lay. Their staff without exception worked splendidly, but the chief credit for the success must be awarded to their managing director, Mr. C. H. Gray. He conceived the scheme and advised the board to take the risks involved; he persuaded the French Government to neglect the doubts expressed by their expert advisers; and he inspired all hands with the zeal essential for such a feat. He was glad to say that the position was fully realised by the French Government, for the Foreign Office had recently transmitted to Mr. Gray the Cross of Chevalier of the Legion of Honour, which had been awarded to him by the President of the French Republic for services during the war. He knew they would all join with him in giving Mr. Gray their hearty congratulations.

Mr. C. H. Gray, in seconding the motion, said he wished to thank the chairman for his kindly references to the work done by the staff.

Replying to a number of questions, the Chairman said that as yet the board had not decided anything with regard to the proposed issue of further capital. The £500,000 reserve fund was entirely invested in their own works, and there was no cash to spare, so there was no possibility of their issuing bonus shares, as that would only involve the issue of still further capital.

The report was adopted, and a cordial vote of thanks was accorded the chairman, directors and staff for their services.

Western Telegraph Co., Ltd.

Sir J. Denison Pender, presiding at the meeting on December 17th, after referring to the increased revenue, said although in the report £450,000 had been transferred to the general reserve fund, it had been debited with £600,000 being part of the cost of the manufacture and installation of new cables. That £600,000 was only a portion of the amount involved by their programme. Since the last meeting they had made an agreement with the Western Union Cable Co. whereby that company would join the Western company's new cable from Brazil at the Island of Barbados with a cable from Florida, thus forming the shortest and most direct communication between the River Plate, Brazil, and the United States. These cables would be of sufficient power, and be equipped with a system of working to enable these two companies to deal with even a far larger volume of traffic than was contemplated to develop for some considerable time, thus providing the nations of South and North America with a service which had become a commercial necessity in these times. The new cable between the Island of Ascension and Rio de Janeiro was successfully laid in September last, and had somewhat relieved the difficulties experienced through the interruption of the original cable to Brazil, nearly 2½ years ago. It was impossible to arrange the manufacture of the necessary cable to lay the new and to repair the old line, and the former was considered of much greater importance, and therefore was carried out first. They had put on order 1,000 nautical miles of cable to renew partially this old line, but would not be able to obtain delivery and charter a suitable vessel to carry out the work until later, the demand for cables elsewhere being now so great. The threatened competition would come into force within the next few months, when rival cables would be laid by the Central and South American Co. between Rio de Janeiro and Santos and Uruguay. Before the war they had just commenced to renew certain of the original cables along the Brazilian coast. This policy had necessarily been suspended for the last five years, as owing to the difficulty in acquiring cable, and the great risk of transport, which was also most difficult to secure, it was absolutely essential to conserve their stocks of cable at the foreign stations. These renewals were now more necessary than ever, and would be effected as soon as circumstances permitted by their own cable ships stationed on the coast. The company was the holder of all the preference shares and 93 per cent. of the ordinary shares of the West Coast of America Co. which owned a single line of cables along the Chilean and Peruvian coasts as far as Lima, and which company was connected to their system on the East Coast by land lines over the Andes from Valparaiso to Buenos Aires. Although the total cable capacity of that company and the Western Co.'s competitors, the Central and South American Co. on that coast was ample for all requirements, the competition was such that he must foreshadow the necessity in the interests of the West Coast Co. and the Western Co. of considerable expenditure, not only in strengthening the existing communications, but in extending the cables farther north. A further £1,500,000 would be expended in the near future, apart from the cost of extensions on the Chilean and Peruvian coasts. The original cables had been submerged for many years, and it was certain that heavy renewals would have to be effected sooner or later.

Aron Electricity Meter, Ltd.—Mr. H. Kahn presided at the annual meeting, on December 19th, owing to the absence of Sir James Pender abroad for reasons of health. The chairman mentioned that Mr. H. Hirst was also away on the Continent on business, partly connected with this company's affairs. He had hoped that Mr. Hirst would have been back in time to give definite information respecting their continental interests. Their chief assets consisted of the factories in Schweidnitz and Charlottenberg, which were incorporated into a German company in which the Aron Co. held all the shares. Those shares were sold after the outbreak of war by the German Public Trustee to German subjects. Their claim on the British Government for their book value plus goodwill had not yet been adjudicated upon. The company also had a factory in Vienna similarly constituted; that company also ran the Hungarian branch at Budapest, which, after having been in Soviet Government hands, was now working again under its own administration. The French company was being liquidated as there were no prospects of it ever becoming a valuable asset. The Belgian branch, whose shares were held by the French company, had had most of its realisable assets confiscated by the Germans, and a case had been lodged with the French Government. The Italian branch shares were held by the German company. Possibly some arrangement might be made for it to be worked for the benefit of the English company. The Madrid branch, which had also been directly managed by the German company, would also have to be adjusted when the settlement was made. The English factory had made sufficient profits to pay interest on debentures and unsecured loan, and head office expenses. The chairman thought that the current year would yield even better results than during the last few years. The future of the company was dependent upon the result of the adjudication of their claims against the British Government for the loss of their German assets. The report was adopted.

Cape Electric Tramways, Ltd.—Mr. L. Breitmeyer presided at the annual meeting in London on December 17th. He said that the Cape Town and Port Elizabeth systems combined showed an increase of 1,548,811 passengers, and £37,653 in traffic receipts. They had had an unexpectedly good season and the systems had been worked to the full extent of their respective capacities. But for the influenza epidemic the receipts would have been still higher. The demands for higher wages were satisfied by an adjustment of fares. There was no prospect of relief, under the existing world-wide economic conditions, in regard to the advanced prices which had to be paid for all supplies and materials required for operation and maintenance. To meet the traffic requirements it had been necessary to order additional cars. The company had heavy burdens put upon it from all sides, and the only means available to meet them was to advance fares.

Marconi International Marine Communication Co., Ltd.—The directors announce an interim dividend of 5 per cent., equal to 1s. per share, less income tax, on account of the current year.

Marconi's Wireless Telegraph Co., Ltd.—The directors announce a dividend of 7 per cent., less income tax, upon the 7 per cent. cumulative participating preference shares, and an interim dividend of 10 per cent., less income tax, upon the ordinary shares, on account of the year ending December 31st, 1919. It is with a view to the more equal distribution of the dividend on the ordinary shares that the board have decided to increase the interim dividend from 5 per cent. to 10 per cent.

French Companies.—*The Compagnie Breguet* reports net profits of 4,507,000 fr. for 1918-19 as compared with 4,184,000 fr. in the previous year. A dividend of 50 fr. per share has been declared, being the same rate as in 1917-18.

The Société d'Electricité de Paris, after making provision for depreciation, reports net profits of 2,548,000 fr. in 1918-19, as against 2,537,000 fr. in the previous twelve months. The directors recommended a dividend of 20 fr. per share as in the preceding year.

The accounts of the *Compagnie Générale d'Electricité* show gross profits of 9,728,000 fr. for 1918-19 or 1,700,000 fr. in excess of those realised in the preceding year. After making provision for depreciation and meeting the financial charges, the net profits are returned at 6,585,000 fr. as compared with 4,821,000 fr. in 1917-18. It is proposed to pay a dividend of 50 fr. per share, being the same rate as in the previous year.

The report of the *Société Industrielle des Téléphones*, which deals with the year 1918-19, states that the cessation of hostilities released for peace production the plant which had been employed for the purpose of the national defence, and the orders for private industry then afforded compensation for the stoppage of Government orders. But the profits for the whole year were reduced by a general strike for a month, the sudden increase in wages, the difficulties met with in obtaining raw materials, the transport troubles, the supply of inferior coal, and the decline in the efficiency of the workmen. The State authorities, who had consented to a depreciation provision of 2,500,000 fr. for 1916-17, refused to allow more than 1,000,000 fr. for 1917-18, and the sum of 2,500,000 fr. voted for this purpose in 1917-18 had consequently been placed to a suspense depreciation account. The accounts for 1918-19, after allocating 1,500,000 fr. to depreciation, show net profits of 3,525,000 frs., which sum has permitted of the payment of a dividend at the rate of 35 fr. per share.

Canadian General Electric Co.—The *Financial Times* states that this company is making an issue of 10,000 common shares of $100 each to be offered to holders of common stock. The shares are offered at £23 per share to English stockholders.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the three months ended September 30th, 1919, of 3s. per share, free of tax.

Eastern Telegraph Co., Ltd.—Third quarterly interim dividend 1½ per cent. on the ordinary stock, free of tax.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter ending December 31st, 1919, on the common stock.

Telegraph Meetings.—We are obliged to hold over until next week our references to the meetings of the Eastern and Eastern Extension Telegraph Companies.

STOCKS AND SHARES.

Monday Evening.

During the three days that precede Christmas, it stands to reason that there is not much interest taken by the public in Stock Exchange securities. Even the most conscientiously-minded writer may feel himself excused from lengthy financial lucubrations at this season of the year. Add to the Christmas feeling a most inappropriate whiff of "flu.," and the grave sin of writing an apology in a preface may possibly be pardoned for this occasion only.

Electric lighting shares are disappointingly unmoved by the result of the action of the House of Lords for giving the quietus to the Government Bill of 1919. It is not supposed that anything approaching its revival will be seen in this country until a Labour Party comes into power. It may be that the fear of an early General Election, with its pronounced possibilities of Labour sweeping the polls, exerts a heavy effect, for otherwise the way would appear to be open to a fairly all-round advance, owing to the returns which the leading shares offer at their present prices. We have seen a few inquiries come into the market, and should these materialise into definite orders, they should not take long to give the market a very different aspect from that prevailing now. Just at present it must be confessed that interest is more academic than practical.

The case of the manufacturing companies is piquant. Their quotations have recently been run up owing to the contention that the proposed District Boards would be more or less obliged to take over existing manufacturers as nuclei, or centres, for the business of supplying the public with cheap electric power. Prices are well maintained as a whole, although the District Boards are not to be. Underwriters have been left with a good deal of stock during the last week or so. Electrical issues have proved no exception to the fairly general rule. Amongst issues which are coming shortly may be mentioned £500,000 additional ordinary or preference from the North Metropolitan Power Supply Co., with the usual borrowing powers.

Nothing has been heard yet of any fresh issue of stock by the Underground Electric Railways of London. The market in Home Rails keeps distinctly hard, and Underground Incomes are receiving favourable attention from the speculative investor, while the shares have also gained a trifle.

Marconis settled down to the neighbourhood of £4, and an active market has sprung up in the new shares on the basis of 12s. 6d. premium. The calls on the new are spread over a long period. Marconi Marines have been unaffected by the declaration of a dividend of a shilling per share. Some temporary difficulty has arisen in connection with the dispatch of American Marconis to New York for the claiming of the rights by proprietors owning certificates that stand in the names of other people. Cable shares are mostly steady after their dulness. The very frank and businesslike apology of the Eastern Telegraph Co. explaining the reason for the delay on the cables, reassured the market that there is nothing essentially wrong with the business.

Further improvements have occurred in British Columbia Electric Railway stocks. It is held that the deferred stock can be now regarded as within sight of a dividend. Optimists look for the rise to be continued. Mexicans are no better. Some there are who declare that present purchases of Mexican Utility and Railway bonds will make a material contribution to the merriment of the buyers' next Christmas.

Withdrawal of the Government's Bill for limitation of coal-owners' profits to 1s. 2d. per ton has caused rises in a fair number of shares in iron, coal, and steel companies. The new Armstrong ordinary came up from 30s. to 31s. 6d., and the preference from 14s. 6d. to 16s. 9d. Rubber shares are also a good market, upheld by the price of the raw material, and other industrials keep harder than might have been expected considering the near approach of Christmas.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Dec. 16, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	5⅝	—	£7 2 3
Charing Cross Ordinary	4	4	2¾	—	7 1 7
do. do. do 4½ Pref.	4½	4½	2¾	— ¼	8 3 8
Chelsea	5	3	3	—	5 0 0
City of London	8	8	11½	—	6 17 8
do. do. 6 per cent. Pref.	6	6	9¼	—	6 9 9
County of London	7	7	9¼	—	7 11 4
do do. 6 per cent. Pref.	6	6	9¼	—	6 9 9
Kensington Ordinary	7	6	4½	—	6 6 4
London Electric	Nil	Nil	1½	—	
do. do. 6 per cent. Pref.	5	6	8¼	— ¼	9 4 8
Metropolitan	4	5	3	— ¼	8 6 8
do. 4½ per cent. Pref.	4½	4½	3	— ¼	7 10 0
St. James' and Pall Mall	9	10	6	—	8 6 8
South London	5	5	2½	—	7 8 6
South Metropolitan Pref.	7	7	1	—	7 0 0
Westminster Ordinary	9	8	5½	—	7 12 5
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	90½	—	6 12 8
do. Def.	1½	33/6	21	—	7 11 0
Chile Telephone	8	8	6¾	—	6 3 1
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	16½	— ¼	*4 1s 7
Eastern Tel. Ord.	8	8	16½	—	*4 15 0
Globe Tel. and T. Ord.	7	8	16¼	— ¼	*4 19 3
do. do. Pref.	6	6	9⅞	— ⅛	6 1 6
Great Northern Tel.	22	22	23½	—3	9 7 2
Indo-European	13	13	48½	—	6 12 4
Marconi	20	25	3⅛	—	8 7 0
Oriental Telephone Ord.	15	10	2⅛	—	4 14 1
United R. Plate Tel.	8	8	7¾	— ¼	*5 2 0
West India and Panama	1/8	1/8	1¼	—	Nil
Western Telegraph	8	8	17½	—	*4 12 9
Home Rails.					
Central London Ord. Assented	4	4	88½	—	6 16 9
Metropolitan	1	1½	24	+ ½	5 4 2
do. District	Nil	Nil	20	— ¼	Nil
Underground Electric Ordinary	Nil	Nil	2	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	4	5	82	—2	*6 2 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	87	— ¾	7 14 10
Anglo-Arg. Trams. First Pref.	5½	Nil	34	—	—
do. do. 2nd Pref.	—	—	3	— ½	—
do. do. 5 Deb.	5	5	61¼	—¾	8 2 8
Brazil Tractions	—	—	6¼	—	—
Bombay Electric Pref.	6	6	13⅜	—	4 9 0
British Columbia Elec. Rly. Pfce.	5	5	59½	—	8 8 0
do. do. Preferrred	Nil	2½	49½	—	5 5 3
do. do. Deferred	Nil	Nil	51½	+9	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	42½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	30	—1	Nil
Mexican Light Common	Nil	Nil	25	—	Nil
do. Pref.	Nil	Nil	25	—	Nil
do. 1st Bonds	Nil	Nil	54½	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8	— ½	*5 0 0
British Aluminium Ord.	10	10	1⅞	+ 1/16	5 14 3
British Insulated Ord.	25	19½	2	— 1/16	6 5 0
Callenders	25	25	8½	— ½	7 11 6
do. 6½ Pref.	5	6½	4⅛	— 1/16	6 11 6
Castner Kellner	25	20	3⅞	+ 1/16	3 15 7
Crompton Ord.	7	10	22/-	+6d.	9 1 10
Edison-Swan, "A"	—	10	1⅞	+ 1/16	8 4 0
do. do. 5 per cent. Deb.	4	5	81½	—	6 2 9
Electric Construction	10	10	1⅛	—	8 17 10
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	40/-	—6d.	*5 0 0
Henley	25	25	2½	—	5 11 1
do. 4½ Pref.	4½	4½	3⅜	—	6 4 2
India-Rubber	10	10	18½	— ½	*5 8 1
Met.-Vickers Pref.	—	—	24⅛	—	5 14 0
Siemens Ord.	—	10	26/-	—6d.	*7 13 10
Telegraph Con.	20	20	28	+ ½	*4 12 6

* Dividends paid free of Income Tax.

MAGNETIC STORMS AS AFFECTING OCEAN TELEGRAPH CABLES.

By EDWARD RAYMOND-BARKER.

(*Concluded from page* 795.)

Anything connected with "Magnetic Storms" vividly interests cable electricians—a term here used in its old-time significance—engaged on board ship or elsewhere in fault-localisation and cable repair work.

Fig. 5—a small part reproduction from fig. 4—shows with scales *ad hoc*—effective E.M.F. and current values—a maximum of 33 volts and 12 milliamperes which, at any time, might have to be taken into account by a cable-ship electrician wishing, after cutting into a cable, to make a series of tests with

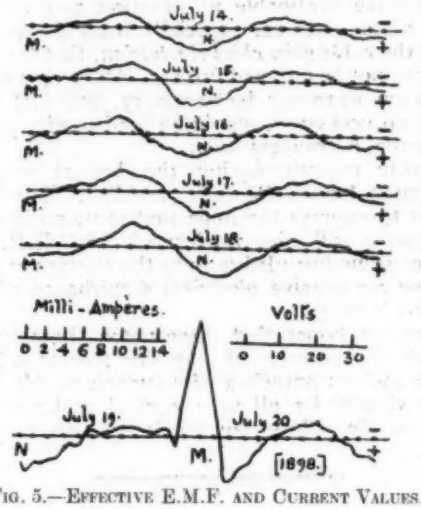


Fig. 5.—Effective E.M.F. and Current Values.

different currents not exceeding 25 milliamperes in order, by Dr. Kennelly's law, to determine true distance to cable break or fault.

For well-known reasons these tests almost invariably are made with *negative* currents, but sometimes this is impossible owing to a perhaps overwhelmingly strong opposing E.C. found flowing from the cable. Under these circumstances, and sometimes owing to other reasons, a series of *positive* currents of various magnitudes have to be used.

These remarks are not a dissertation on cable-fault localisation, but they emphasise how keenly the cable electrician's work and responsibilities are affected by electric or magnetic storms. For this reason the writer ventures to draw attention to a device of his shown in fig. 6.*

Here Kelvin-Varley slide resistances (100,000 ohms) are utilised for the rapid adjustment of any desired sets of currents successively used in Kennelly and other cognate methods for bridge tests to line; exact effective current values being severally indicated on the milliammeter M.

The writer has been much interested by Dr. Chree's differentiation between natural and artificial "magnetic storms." Once the writer had for an entire month almost daily to make "month's guarantee" tests on a cable landed close to an Atlantic seaboard city where, owing to the great underlying natural substratum of stone, artificial magnetic storms promoted by local electrical workings—day and night—were *endemic*. Did space permit, he could tell much of interest showing how difficulties were successfully overcome.

Just 101 days after Dr. Chree had lectured to the I.E.E. on Magnetic Storms, one of these—a very formidable specimen—during August 11th and 12th stirred up, and proved somewhat trying to the world's electrical nervous system.

Details concerning some of the results were chronicled in the Electrical Review of August 15th. The Electrical Review of August 29th, reproduced the letter written to *The Times* by the Rev. Father A. L. Cortie, S.J., of Stonyhurst College Observatory—a communication replete with magnetometric detail.

Further particulars appeared in the "E.R." of September 19th and September 26th respectively, relating to the magnetic storm's holding-up performances on South African land-lines, and to serious interference with telegraphic operations on North American long-distance lines—not only throughout the North and West, but also over circuits running North and South.

Thus readers of the "E.R." are well informed regarding this matter, and the present writer begs leave to carry on a bit further only in view of his having taken advantage of the opportunity to settle what, to many people, is a much debated point, namely, the extent to which a really bad magnetic storm can and does interfere with the working of long-distance cable circuits using, at both ends, electrical condensers. In fact, reference has already been made, in this article, to the manner in which these condensers render harmless even very strong earth-currents.

In this matter, good-natured banter is common. When a cable man commiserates with a radio or "wireless" friend on the latter's exasperating experiences with "atmospherics," the radio man thinks it an effective retort to reply: "How about

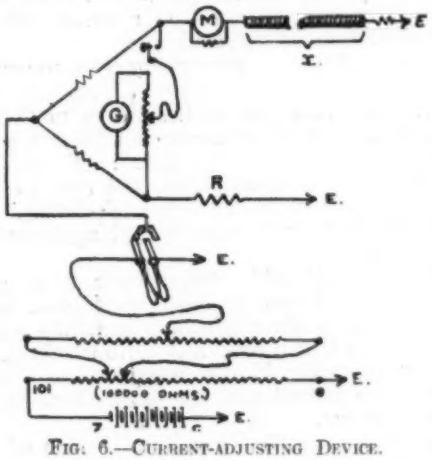


Fig. 6.—Current-adjusting Device.

earth-currents?" ignoring the fact that nothing short of a first-class magnetic storm can interrupt working on properly protected cables. The reason that a true magnetic storm may affect cables is due to the electrically shattering effect of jerkily-rapid changes in polarity and potential.

To settle the matter, then, the present writer appealed to leading cable authorities as to the extent of disorganisation—if any—caused on the ocean cables by the magnetic storm of August 11th and 12th.

With generous kindness the authorities have replied.

Writing (September 3rd) from Superintendent's Office, Central Cable Station, Electra House, Lon-

* Quoted on pp. 317-318 in Mr. H. R. Kempe's *Handbook of Electrical Testing* (7th Edition). See also *The Electrical Review*, August 21st, 1903.

don, Mr. J. G. Youngson, Superintendent of the Eastern Telegraph Co.'s London Stations, replied as follows:—

". . . . On my return from annual leave I received your letter *re* the magnetic storms, &c., which occurred on August 11th and 12th last during my absence.

" As you are probably aware, all our cable circuits are worked with receiving condensers which effectually block out earth currents.

" During heavy magnetic storms such as those to which you refer occasional kicks are noticeable on the receiving instruments causing a few repetitions and reversion to simplex working for short periods, but it is never necessary to suspend working owing to such disturbances.

" If there is any further information you would like I shall be most happy to assist you either by letter or at a personal interview at these offices, when occasion could be taken of showing you the various service messages received from our stations affected by the magnetic storms.

" With kindest regards and best wishes, &c."

The present writer subsequently visited Electra House, where the aforementioned service messages were most obligingly shown to him.

Other high authorities severally controlling various great ocean cables running East and West could not claim the same degree of comparative immunity from trouble as that enjoyed by the E.T. Co., whose cables severally lie—it may well be said—through all points of the compass.

One correspondent frankly owned that the late magnetic storm upset working seriously. Only once before had he seen earth currents so powerful and rapid in change of sign. That was at Valentia some twenty years ago, when a heavy magnetic storm occurred, and, as the late Mr. James Graves then described the episode, all the Kelvin siphons were seen to sweep through almost complete circles, virtually standing on their heads alternatively *positive* and *negative*. On that occasion the E.C.'s were as regular as reversals from an automatic transmitter, and, judging by size, were due to an E.M.F. double the working normal. Our friend adds that rarely indeed do condensers fail to protect the cables; but the storm last August certainly took command.

A friend writing from another part of the world found it impossible during the storm to maintain duplex, as, even using unshunted condensers, a " recorder " zero could not be kept at times. The attacks came on quite suddenly, and rose to maximum intensity almost at once, declining, after various periods, to moderate strength again until the next outburst.

From one great cable station we hear of a condenser shunt, in a sending block for duplex, having been burnt out, while condensers generally were so highly charged that it was risky to touch them.

Reports from the North American coast tell of cable voltages of well over 100 having been attained during the storm.

From France mention is made of E.C.'s of enormous strength, so much so that, after one outburst early on August 12th, one cable was found to be interrupted, though this may have been a coincidence.

E.C. voltages on a cable between England and Russia seem to have risen to between 200 and 300.

At a certain representative station controlling cables lying E. and W., the perversities of the quite unexpected storm (last August) did not succeed in entirely interrupting work on any main cable, excepting during one half hour when variation of E.C. high potentials was very abnormally abrupt.

Finally, mention may be made of the trouble the August magnetic storm caused to cable ships. Much cable repair and relaying work was held up at different times, to be resumed now and again as the stress lessened, and then under only slow speed and difficult conditions until, at last, after two days of erratic confusion, the magnetic storm subsided.

This last only too fragmentary allusion to work on the cable-repair ships brings to a head an idea which the present writer now puts forward in the form of a suggestion—a suggestion that, with due respect, he begs to submit to all authorities concerned.

It is that a systematic service of warnings may be organised, to emanate from one or more magnetic observatories under the jurisdiction-in-chief of the director of the meteorological office. These warnings would, if possible, be transmitted far and wide through the medium of the radio service. At the present day many important cable stations have their own " wireless." Not only would the cable stations benefit by being able to make any necessary modification in their highly complex electrical plant, but cable-laying and cable-repair ships would, by " wireless," receive invaluable information and warning. This is all so obvious, especially from the point of view of the cable ship *chief electrician*, that the argument need not be pursued further. Only very seldom would such warnings be necessary, but that warnings, when necessary, would be forthcoming, would be, to many, a priceless boon.

In many regions during the August magnetic storm much Aurora Borealis prevailed. The writer ventures to express the hope that some radio friend or authority will give readers of the " E.R." the benefit of some knowledge as to the manner in which that same remarkable electrical disturbance affected " wireless " work.

The writer hopes that these notes showing how intimately the question of magnetic storms is linked up with various branches of submarine-cable work, will be viewed by all as a cordial and respectful tribute to Dr. Chree for his lecture on magnetic storms.

SCIENTIFIC MANAGEMENT: A SOLUTION OF THE CAPITAL AND LABOUR PROBLEM.

By Captain J. M. SCOTT MAXWELL, B.Sc., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 799.)

Instruction of Workers.

After analysing the job, fixing the time, method of payment, and selecting the proper man, Scientific Management then proceeds to teach the man how the job should be done. The teachers are the best men picked out of the shop. This means therefore a better and higher class of job for these men, which will call on all their mechanical experience and also develop their characters by the tact, initiative, and ability they will require to instruct, assist, and handle the men on the job. Scientific Management raises both the teacher and the worker to a higher level of intellect and character. The consciousness that his efficiency and increased skill enable him to do more difficult work than he could otherwise do increases his self-respect both as a worker and as a citizen. The ability to do more work and better work with the same or less energy than previously required for inferior work, combined with the incentive of a higher reward, increases his power of concentration and consequently his interest in the work. Scientific Management creates interest and incentive—not monotony.

The unions do not like all this because they think it lessens the value of craftsmanship and makes the employer less dependent on the skilled man. As a matter of fact, Scientific Management has the same tendency as the introduction of improved machinery. It may temporarily displace labour, but ultimately it will mean the employment of as many craftsmen as we have now, and many more men recruited from them, with a higher training than is necessary under the present system. The tendency is to raise the standard of each individual all the way up from the lowest to the highest. Dr. Taylor held very strong views on this. He explained to me how once he had been severely criticised by his superiors because he had helped his best assistant to get a job in another company. They argued that he had lost the services of a good man. Taylor maintained that it was bad policy to keep any man at a job if he was capable of a bigger job. If it was not possible to promote him, a better job must be found for him in another company. By doing this he always

had the complete confidence and loyalty of all his assistants and maintained their incentive, as they knew they would under all circumstances be rewarded according to their efforts. This is a great gain, greater than the actual loss of an individual grown too big for the organisation. It is a gain to the individual, to the industry and to society. It is the scientific spirit at its best, and no example could refute more strongly the statements of its opponents that Scientific Management is nothing but an all-round degradation of the worker.

Organisation.

As Taylor specialised the work of the manual worker, so he specialised the shop and office organisation on the same functional basis. He takes eight men and puts them each to perform a definite function. Four of these are located in the shop and four in the office.

In the shop we have what he calls the gang boss, the foreman responsible for preparing the job for the worker, getting out drawings, instructions, jigs, tools and material, everything the man requires, but who is not concerned with the actual work on the job. This is attended to by the speed boss, who sees that the proper tools are employed and the best speeds, feeds, and depths of cut are used. The inspector is responsible for passing the quality of work before bonus is paid. Without inspection of results, Scientific Management is impossible. The fourth man in the shop is the repair boss, who is responsible for the maintenance of the machines.

All possible clerical work is removed from the shop to the office, as the qualities required by the shop foremen make bad clerks of them. The head and heart of the production system in the office is the planning department which, according to Taylor, has also four distinct functions. The order-of-work or route clerk makes out daily lists covering "the exact order in which the work is to be done by each class of machine or men." The instruction-card clerk issues all the necessary instructions to the workers. The time-and-cost clerk gives the men all information they may demand regarding times and rates, and collects from them data for the cost records. Lastly there is the shop disciplinarian, who acts as peacemaker between men and foreman and adjusts all disputes.

The planning department has two chief functions to perform. The one which gives it its name requires much information to plan properly, and much energy and initiative actually to push forward production through all the various channels. The other function is the purely clerical one of keeping records. Even if the Taylor system of motion and time study cannot be adopted because of the attitude of the men, the ordinary rate-fixer will be necessary. The instruction part of the system requires collaboration with the drawing office and the shop foremen, also the exercise of much tact with the men. It is practically non-existent in our present system. The peacemaker has arrived, but we usually call him a welfare superintendent.

The planning department must see that its plans are carried out. If there is a check anywhere in the process of production due to lack of men, machines, tools or material, it is up to the planning department to forestall that check if possible by seeing it in advance, and if this is not possible, to see that it lasts the minimum time, by altering the plan or hustling and assisting the departments at fault. The drawing up of a plan of work is comparatively easy and seldom produces results. It is the execution of the plan that determines the efficiency of the organisation.

No firm should attempt the introduction of Scientific Management, even with the approval of the men and the unions, unless the office and shop organisations have first of all been put into shape as has been outlined in this paper.

Remove inefficiency, raise wages, shorten hours, improve conditions, create incentive, and individualism will beat any form of socialism. To quote Dr. Taylor: "Among the risks of a manufacturing business, by far the greatest is bad management. This risk arises not so much from the evident mismanagement, which plainly discloses itself through occasional strikes and similar troubles, as from the daily more insidious and fatal failure on the part of the superintendents to secure anything even approaching the maximum work from their men and machines." This "daily more insidious and fatal failure" is pre-eminent in most Government undertakings.

Guild socialism seeks to raise the status of the working man by the methods of the politician. The word "committee" has become almost a magic one in these days. Whenever there is a difficult problem to solve, the Government appoints a committee to investigate it. What a travesty of the truth it is to think of the late Coal Commission, for example, as a scientific investigation. It was one of the most glaring examples of how investigation should not be carried out. It was the negation of the scientific ideal.

We are ruled by opinion, and scientific fact is held to be of secondary value. The unscientific opinions of the majority are not the truth. Democracy is a theory of politics founded on payment by results. If the electorate is slack or foolish, it suffers; if wise, it is rewarded. Our politics are very rule-of-thumb, and until the people have knowledge in place of opinions and prejudices, the demagogue will always score over all who try to lead and not fool the people.

Individualism, directed by the scientific knowledge of experts and recognised as such by the educated intelligence of the workers, will carry civilisation more quickly to a higher plane than socialism based on discursive and rule-of-thumb methods of production. Further advance will be by knowledge gained in the laboratory and the application of the scientific method throughout the whole realm of human effort.

Our prosperity a century ago was due to the fact that other countries did not have machinery. Now it is common to the civilised world, and our prosperity will depend on our ability so to organise human effort that we shall be able to produce more with less labour. Material wealth must no longer increase the power and comforts of the few; its justification must be the amelioration of the lives of the many. Our present system, being very inefficient, can give leisure and opportunity for culture only to the few. If democracy is to win against anarchy, it must win leisure and opportunity for the many.

Labour leaders emphasise the waste of human life through industrial accidents and bad conditions, but they fail to realise that the waste of human life because of inefficient work is far greater in its total results. They not only fail to see this waste of life, but by their teachings and action do everything to maintain it, actually arguing that the elimination of this waste would be bad for the worker.

As long as opinions have the upper hand of facts, because of the inability to distinguish the one from the other, so long will the unscientific attitude dominate the country, and we must continue to pay for so many mistakes which would never be committed if the scientific attitude were developed in the Government and the people.

Scientific management is a higher and more complex type of management and requires greater discipline and intelligence from everyone. We are the most disciplined of peoples, which does not mean the autocratic form that Germany tolerated and suffered under, but the self-discipline of a free democracy. Scientific management is only advisable and possible in a community of free people. Don't let us be afraid of it, and while believing in it, tackle it by small and secret methods. Let us proclaim it widely and fight for it openly by every fair means. We are probably the only people who can tackle it on a national scale. Nothing short of a national movement, involving capital, labour, and the Government will achieve what is required. It is a very big thing that we have to do.

One of our greatest national assets in the present difficult times is the advanced state of British trade union organisation. Do not let us belittle it or fear it. We lead in this direction and the most advanced countries follow us. The British working-class has produced many men of whom we have every reason to be proud, and, in spite of all we hear to the contrary, the mass of the workers are sound and will respond quickly to an open and honest policy of education and leadership. The war has tried our young men of all classes, and they have not been found wanting. The present situation requires the faith, the courage, the optimism of youth to overcome the forces of reaction, whether on the extreme right or left of the industrial and political army. Give the younger generation more scope, encourage them to think and act in these matters, and the country will win through more quickly. We have in the stable and industrious character of our people a far greater asset than we can ever have in the most ingenious machines. If we realise that fact in time, the history of Great Britain in the twentieth century will eclipse all its previous history in its progress towards a higher culture and a better life for all.

ELECTRIC POWER SUPPLY.

At Manchester, on December 2nd, a discussion took place before the North-Western Centre of the Institution of Electrical Engineers on the present position of electric power supply.

Mr. Pearce opened the discussion, and said there were two sides to the question, one administrative or political, and the other technical. As far as the administrative side was concerned their fortunes were bound up with the Electricity (Supply) Bill. He had become more and more impressed with the tremendous powers it was proposed to give the Electricity Commissioners. At the present time there were four alternative types of governing authorities: (1) An undertaking already operating over a large area and able and willing to extend, which might be allowed to go on as at present. (2) A voluntary co-ordination of existing undertakings, one authority being empowered to raise capital for interconnecting works, to control running hours, and generally to act in an advisory capacity as regarded extensions, but without power to acquire the ownership of an existing undertaking. (3) A joint authority on similar lines, except that it would have power to acquire existing undertakings. (4) The District Board which would be set up if the authorities failed to come to an agreement. The distinction between the last two seemed to be a very fine one. He would emphasise the fact that a tremendous responsibility was laid upon all undertakings. They must face the issue, and combine upon a voluntary basis, or a District Board would be imposed upon them. All concerns had the option of parting with the whole or part of their undertakings, and there was an

inducement to the companies to go out of business. The transfer from the Board of Trade to the Ministry of Transport came with somewhat startling suddenness. Three reasons were given; First, the affinity that was likely to exist between transport and power. He was not disposed to seriously quarrel with that, although at the present time the electrical energy that was likely to be absorbed in railway electrification was a comparatively small percentage of the total output, but it might be stressed too far. Then it was said that the Board of Trade lacked the necessary energy and initiative for handling a scheme of this magnitude. The third point was that the Board of Trade had not got the staff available. He could not see that those arguments carried them very far, and he thought there must be something which had not been disclosed. The Minister of Transport had stated that the commissioners would be absolutely independent of the transport side of the Ministry, and they would wait with interest to see how that guarantee was translated into definite words. Undoubtedly there was a fear that the industry would not get fair play, that it would be overshadowed by larger and more pressing interests; but they must take a broad view, and remember that this legislation was intended to be not for any particular interest but for all. The ultimate solution of the technical problems would largely depend upon whether the existing local stations were perpetuated or replaced by larger stations. The latter course would involve more transmission lines. The conditions most favourable for economic generation of electricity usually existed at a spot more or less remote from the centre of gravity of the load. He had embodied in a tabular form data relating to six more or less typical stations in Lancashire, Cheshire, and Yorkshire for the financial year ending March 31st, 1918, and also similar data estimated for a large power station operating with a 60 per cent. load factor. By means of curves he also compared the costs of transmission by 30,000 and 60,000-volt overhead lines, or 30,000 and 60,000 underground cables. Coal was taken alternatively at 15s., 20s., and 25s. per ton. A very slight difference in the cost of fuel would make a substantial difference in the cost on the super-station busbars, and affect substantially the radius within which it would be economical to transmit with a 30,000-volt line; a reduction from 20s. to 15s. per ton increased the economic distance of transmission from 16.8 to 28.5 miles. It showed what an enormous influence the cost of fuel had, and he would emphasise the importance of securing for the future power stations a supply of comparatively cheap fuel.

Mr. WATSON asked the members to consider what line engineers would have taken 20 years ago if they had then possessed the knowledge and experience in regard to large generating stations which had now been obtained. They would not have built small isolated plant, and transmission would have been over an area of, say, 100 sq. miles. One station could not possibly deal economically with the large output required by an industrial district like Manchester, where the future demand would be something like 750,000 KW. Therefore, a certain amount of decentralisation must take place. The present position was that a large number of detached stations were already in existence, and the question was: How could they be best used in the interests of the country while at the same time developing the principle of large generating stations? Many of the smaller stations were working fairly economically, and the capital expended on them must be utilised to the greatest possible advantage. They would continue to operate in parallel with the larger plant, at any rate during the period of maximum load. During the period of light load a supply could be taken at a moderate price from the principal plant, and in this way the economic position of the area would be much improved. He emphasised the very close attention which was given to the Bill in Grand Committee. He thought it was owing to the free and frank discussion which took place there that some clauses in the Bill had been srtengthened, and the changes would arouse less opposition than would otherwise have had to be dealt with. This would facilitate the adoption and carrying into effect of the Bill. The Joint Electrical Authority was, in his view, the form of organisation which would be most generally adopted. It began by voluntary effort, but machinery was set up in the Bill which would enable the Joint Authority to exercise the same powers as the District Board. Progressing by slow stages, which would enable the authorities to get together more easily, they would ultimately get co-operation right through the whole thing, and the Joint Authority would operate as the actual owner of the whole of the undertakings. It seemed to him that if the electricity supply was to be cheapened the authority must have complete power.

Mr. WHEELWRIGHT urged that all differences and petty jealousies should be now put aside in order to make the Bill a success. There was now an opportunity of making electricity the most important thing in the country. His own experience was that in the cotton trade and in others the cost of power was comparatively a small question, but manufacturers wanted to be relieved of the worry incidental to the production of power. Future extensions in the cotton trade would be on an electrical basis. In his opinion, it was a mistake to call the proposed large stations super-stations. Possibly the term originated with those who were opposed to the progress of electricity supply. At the moment it was more a question of gradually increasing the capacity of the stations, taking every advantage of improvements in machinery, and eliminating the stations which became obsolete. In the *Daily Mail* recently Lord Moulton compared gas with electricity. But the public was not going to worry about getting the last 5 per cent. of efficiency, and it was no use to tell the consumers that gas was more efficient and cheaper than electricity. He would reply that he would have to pay the bill, and was going to have what he wanted. The competition of electricity tended to make the generation and use of gas more efficient; he had no doubt that without such competition the gas oven would be to-day what it was 40 years ago. In the past the importance of the boiler-house had been somewhat overlooked, and many generating stations did not take sufficient care in the burning of coal. In considering possible economies in the boiler house the first thing that struck him was that they must have very highly skilled men. It would be a good thing to have a chemist on every shift, an educated supervisor. The skilled men in the boiler-house must be paid for their skill; he thought wages were almost a negligible factor; they constituted a small item in the total costs of the generating station. If 5 per cent. of the coal could be saved the resulting gain in a station, say, with a 10,000-KW. load, would be so great that a good wage could be paid. It used to be said that the men were gaining experience, but in future that consideration would have little weight. The men in the boiler-house must be paid on results, and they could be paid well if there was a corresponding saving on the material, especially coal, to make distribution over long distances profitable; the load was there, it was only a question of taking the opportunity. Most supply engineers would agree that the position to-day was that so far from a canvassing department being needed, the difficulty was to keep the customers quiet until they could be supplied. Research work had been very backward. There was room for both gas and electricity. In his opinion they would ultimately combine. He believed the companies and municipal authorities were not making profits out of the sale of gas so much as out of the sale of its by-products.

Mr. J. FRITH, considering the subject from the consumer's point of view, agreed that the electricity supply of the country should be concentrated in one hand and in one interest. But in whose interest? Was it to be that of the supplier or of the consumer? Combines were good things when they were worked well; they were bad when they were not worked well. They had all been suffering recently from flagrant examples of that. The prospect of having to burn 100 tons of coal to get the equivalent of 19 tons on the busbars was not attractive. They saw the loss incurred in transmission. It seemed to him impossible to get cheap fuel by burning raw coal and transmitting the energy of the coal by means of steam. Out of, say, 1,250 B.T.U. per ton 1,000 was absolutely irrecoverable. It was necessary to get research work out of the laboratory, and put it on a business footing, and see whether they could not get something better. From the financial point of view great economies might be effected by the utilisation of by-products, but the waste of power would go on as long as they were wedded to steam, and the best they could do was based on a thermal efficiency of 15 or 16 per cent. It was worth while spending money on research for something better.

Mr. LAMB said that three or four years ago it was generally agreed that engineers were largely to blame for disunion in the industry. One municipal engineer came somewhat near the truth when he said that each one would be enthusiastically in favour of the new scheme if he knew he had a chance of becoming one of the Commissioners. The problem to be solved in this country was different from the problem in any other part of the world, and engineers were too much in the habit of imitating what was done on the European and American continents. South-East Lancashire was one of the most favourable districts in the whole country for the further supply of electricity; within a 12-mile radius of Manchester there was a load to-day approaching 200,000 KW. Obviously inefficient stations must be shut down when another supply was available. There were three alternative sources of this new supply—(1) large stations on the waterways transmitting 30 to 40 miles, in which case the transmission would add something like 30 per cent. to the cost of generation; (2) large stations nearer to the load equipped with cooling towers failing a natural supply of water, which worked out at 10 per cent. increase for transmission; (3) small stations equipped with plant similar to the smaller units of the very large station, and working under similar conditions as to vacuum, temperature, and pressure. The increase there was something like 25 per cent. It seemed to him that the solution of the problem in South-East Lancashire would be three or four large stations situate 15 to 20 miles apart and connected by transmission lines.

Mr. ALLCOCK pointed to the extraordinary growth in transmission, evidenced by the fact that Manchester and Salford were linked together by a 33,000-volt underground cable, which would be suitable for a working pressure of 60,000 volts. Manufacturers must feel that the task of solving the problems of the national demand for electrical power had been greatly simplified by the technical progress made in the last few years.

Alderman WALKER said while research was being made into the best methods of converting heat into power there was an immediate demand to be met with the means at their

disposal. He did not agree with any of the arguments in support of giving the control to the Ministry of Transport, but he supposed the last word had been said on the subject, and the industry must now see that the powers given to the Commissioners were sufficiently strong to enable them to hold their own against any attempt to make electricity supply subordinate to the railway interest. Working together would be the keynote of success. In the past petty jealousies had hindered development on the right lines.

Mr. Paxton said that last winter he read a paper before an association of textile engineers, and found them highly critical of proposals to change over to electric driving. A strong argument was that they would be able to concentrate on their own business and leave the worries of power generation to the man who was paid to look after it.

Mr. J. D. Paton said co-operation must not be limited to electrical engineers, but must extend to other industries. He agreed as to the necessity for the better utilisation of coal, and suggested that it would be possible to distil the coal at the mines, secure the advantages of the by-products, and convey the gas or coke to the industrial districts where power was required. He urged Lancashire engineers to attend to these questions themselves, make up their minds as to the best method of producing electricity, and form a committee to carry it into effect.

Mr. Pearce, in replying, said it was impossible to lay down hard and fast rules on transmission. Each specific case must be considered on its merits. He did not agree with the suggestion that the large stations of the future would be of the order of 250,000 kw., the figure would be much nearer 100,000. There would certainly be an economy in capital expenditure, and the increased capacity would lead to economy in operating costs so long as the increased capacity was brought about by the adoption of the largest possible unit. A modern station should not contain more than six or eight units. In the boiler-house to obtain the maximum efficiency it was quite as important to keep down the number of individual boiler units as to raise the output. If gas engineers could put forward a satisfactory scheme for taking gaseous fuel it would be welcomed, and in the meantime there could be co-operation in other directions. But he did not suppose anyone present contemplated the use of gas engines for power production on a large scale.

NEW SOURCES OF POWER.

In his "Trueman Wood" lecture to the Royal Society of Arts on December 10th, Sir Oliver Lodge dealt with "sources of power known and unknown." After discussing solar radiation, the internal heat of the earth, and the tides, Sir Oliver drew attention to two other sources of energy—one certain, the other rather hypothetical: the energy of the atom, and the energy of the ether. The latter, if it existed, as he thought it did, was enormous, exceeding the bounds of imagination; but at present it was utterly beyond their reach. Atomic energy was rather inaccessible too, but not hopelessly so. It was far less in amount than etherial energy, but it was immense compared with any form of chemical or molecular energy, such as that derived from combustion or explosives.

By atomic energy he meant the constitutional energy of an atom—the energy which made it what it was. If that energy was given up in any considerable degree, the substance ceased to be what it was, and became a substance lower down in the scale. Utilisation of atomic energy would involve the stepping down, the degradation, of matter.

This spontaneously happened in the phenomenon known as radio-activity. A radium atom firing off a particle, which turned out to be a positively charged atom of helium, was like a two-ton gun firing a hundred-pound shot. That was about the actual proportion between the projectile and the rest of the atom, which naturally recoiled each time it fired. The recoil had been observed. Before it had exhausted its ammunition it fired off five such projectiles, and then settled down into a quieter existence as lead—or something chemically indistinguishable from lead. A uranium atom had already fired off four projectiles in order to become radium. It would seem that all substances of very high atomic weight were liable to behave in this way—it was only a question of degree. The energy retained was far more than the energy expended.

Two kinds of projectiles were fired off by a substance—the heavy shot or alpha ray, which was known to be a helium atom, and the lighter shot or beta ray, which was the fundamental unit of electricity, the negatively charged unit particle—an electron. Several electrons might be expelled, and they would not make much difference to the weight of substance left behind, but they would have left it positively charged; and in that case it was liable to fling away one of its massive positively charged particles, too. One event followed the other, and whether the electron always escaped first was uncertain.

Many circumstances could stimulate the escape of an electron; not, indeed, of the deeper-seated constitutional electrons, but of the outlying superficial charges which were responsible for chemical affinity. Mere friction removed some of them, and left the substance positively charged. The removed electrons would have gone to the rubbing substance, and would have charged it negatively. Splashing of water, chemical action in innumerable forms, effected the transfer of electrons, and consequent charging of bodies. Ultra-violet light falling upon clear metal, and indeed upon a large variety of substances, caused electrons to be expelled, until the surface was positively charged enough to hold them back. The discharge would go on continuously if more were supplied from a battery. The jostling of the molecules by heat would often cause electrons to escape, but not usually until a temperature of red or white heat was reached. Singularly enough, a comparatively low temperature would emit a few positive particles for a time, as it were, but this emanation soon ceased, the material got tired as it were, and had to be reborn or renewed somehow, if the process was to be continued. Not so with the negative emission from hot bodies. This would go on as long as fresh particles were supplied.

By the aid of X-rays, or of projectiles from other atoms, we were beginning to learn how to disturb effectually, and even to eject, the deep-seated constitutional variety; though usually others immediately took the place of the ejected ones, with consequent radiation of definite type. They could not alter the spontaneous rate by anything they as yet knew how to do.

The modern view of an atom was a central positive nucleus like a sun, and a revolving system of negative electrons like planets. The electric planetoids, so near this "sun," and subject to its powerful electrical attraction, must be revolving with prodigious speed with a frequency of orbital revolution exceeding in most instances even the frequency of light—a frequency only attained in general by the ultra-rapid X-rays. Accordingly, these little bodies had plenty of kinetic energy, and when they escaped as beta rays, they did so with something like the velocity of light.

The positively charged nucleus was in different case. Its energy was more likely to be static, *i.e.*, potential, like things held or caught together, as a detent may hold a strong spring. Let these be liberated, and they flew with great violence, presumably under the electrical repulsion; the potential gradient was at first enormous, so that each atom where it struck a zinc sulphide target made a luminous splash.

The projection of an alpha particle was literally an explosion, and the force could very quickly get up an enormous speed—sufficient to carry it to New York, if there were no obstruction, in a quarter of a second. Its energy was, therefore, weight for weight, a million times that of a bullet. Only because an atom was so small did it fail to do any damage.

The number of projectiles from a milligramme of radium was about thirty million a second; hence, in the aggregate, they generated a very perceptible amount of heat. No one could deny that the energy was there. The main difficulty was to understand hoy they were retained and packed together into the minute nucleus.

The negative electrons probably escaped with the velocity with which they were revolving in their orbits before perturbation. Their energy of ejection was found to depend on the frequency of the radiation which stimulated it; a fact which at once suggested a storing of received synchronous vibrations, till a quantum of energy sufficient for ejection had been accumulated. Moreover, spectrum analysis of the derived or secondary X-rays, emitted by a substance exposed to radio-active bombardment, was also a test of the frequency of orbital revolution.

The amount of energy thus quietly existing in the atoms of any visible piece of matter was enormous. In a couple of grammes of matter the energy was 10^{19} c.g.s. units or ergs. Now a ft.-ton was 3×10^{19} ergs. Hence the energy of a few grammes of matter was three hundred million ft.-tons, enough to raise a hundred thousand tons 3,000 ft.

No doubt a large store of energy was there; the practical question was, could they get at it and utilise it? That the activity of radium, thorium, and other radio-active substances was employed therapeutically was well known. That was the beginning of practical application of the energy given off.

Atomic energy might unconsciously be being utilised in other ways, too. He had lately put forward an incipient radio-active theory of vision: he surmised that in the retina there must be a substance which could be stimulated into activity by the impact of ether waves of luminous frequency, that the substance then ejected a few of its outlying electrons, and that these stimulated the nerve-endings in their immediate neighbourhood. But the way an etherial vibration stimulated the optic nerve had not been made out; it was not a mechanical, but an electrical question. Radiation of light frequency was known to be received and stored until it was able to eject a negative particle with whose orbital frequency it happened to agree. And certainly such a particle when ejected could be depended on to stimulate a suitable nerve-ending.

It was on those lines that he would explain the extraordinary sensitiveness of the eye. For the accumulation of a few million impulses would take no appreciable time, and it was difficult to suppose that in any other way than by synchronisation with equally rapid motion, could matter be perturbed by the extraordinarily rapid vibrations of ether—hundreds of millions of millions per second. Nothing larger than the ultimate elements of the atom could be expected to follow such rapidity. Molecules of matter would be almost too massive and gross to be readily moved as a whole; and, besides, their movement as a whole would only result in heat.

The same sort of idea could apply to the stimulus of a sensitive photographic plate, only here the chemical atoms were attuned, as a rule, to still higher rates of vibration, and were susceptible beyond the ultra-violet, into the region of chi and gamma rays.

It was possible that the absorption of solar energy by chlorophyll in plants might also in some way utilise atomic energy, stimulated into catastrophic activity by light waves.

Of late an application of atomic properties in vacuo had undoubtedly been made. Ordinary electric valves depended upon the different behaviour of positive and negative particles, and an electric bulb containing a positive electrode and a hot-wire cathode was employed, some years ago, as a receiver for wireless telegraphy, by Prof. J. A. Fleming. When the hot wire or filament was negatively charged, a stream of electrons reached the anode. When it was positively charged, the emission was checked. So if an alternating current was received, the emission of electrons was alternately helped and hindered, and thus the current was rectified and made capable of being received by any ordinary instrument. The cutting-up into signals had to be otherwise managed, for the alternations were too quick to be acoustically perceived.

Then Lee de Forest introduced an improvement, and made it not only a wireless receiver but a relay or amplifier; and so a received message that in itself would be hardly audible could be magnified a hundred-fold.

A positive grid promoted evaporation, a negative grid checked it, an alternating grid caused an alternating stream to pass through it; and the electrons could follow every minutest fluctuation; for their inertia was as nothing, and they responded instantly to the slightest force.

To get quickness of response the projectiles must not be allowed to bombard other molecules, so as to ionise them and render the whole atmosphere conducting. For this ionisation would not subside instantaneously, and therefore the current would not be completely under control. To avoid ionisation by impact the reservoir must be very highly exhausted, and the current ought to depend on the projectiles themselves, not on their secondary and adventitious effects.

The kind of electric emission from a hot wire differed greatly from that stimulated by ultra-violet light or X-rays. These vibratory agents dug right down into the constitution of the atom, and ejected electrons whose orbital frequency agreed with their own.

The "harder" the ray, that was, the higher the frequency of the impinging radiation, the higher the velocity of the ejected electron—evidently because one of the innermost orbits was then perturbed. For in inner orbits the speed must be high, in accordance with Kepler's third law. The orbital speed varied inversely with the square root of the radius of the orbit. And the more massive the nucleus the greater the speed necessary to balance the centripetal force.

But the jostling of atoms by heat produced no such deep-seated effects. The effect of heat was as if a kind of atmosphere or crowd of stray electrons, in a metal, evaporated and escaped.

Whether heat was the best way of promoting this electronic emission might be doubted. It seemed an extravagant method, analogous to employing an electromagnet where a permanent magnet would do, or to supporting a roof by a jet of water. But the other kind of stimuli, such as those promoted by radioactivity or ultra-violet light, did not seem to generate the right kind of docile emission. The very-high-speed electrons would require too much potential to hold them down. The speed of emission of electrons from a hot body was indefinite and irregular, being distributed in accordance with Maxwell's law for a monatomic gas. Moreover, the escape through the skin of a metal was equivalent to an escape against a "contact" difference of potential; and thus, in some cases, the electrons might be said to ooze rather than to fly out, and to owe their subsequent speed entirely to the external potential gradient in which they found themselves.

That state of things would be quite convenient for wireless telegraphy, since they would then be still more readily under control. The skin retardation exerted by tungsten had been measured as 4.6 volts, unless he was mistaken.

One relay could be used to stimulate another several times in succession, and immense magnification attained; the electric stream was so rapidly responsive and docile that it could follow fluctuations that no mechanical relay could possibly follow. Spelt out, without abbreviation, in dots and dashes, the words came on to the tape at three hundred a minute, five a second or thereabouts.

Ordinary speech itself could be thus wirelessly but electrically transmitted, with quite good clearness of articulation.

It was by the harnessing and practical utilisation of purely atomic properties, that all this great advance in practical electrical engineering had been accomplished. The conclusion was inevitable that much more remained to be done.

A French Amalgamation.—An agreement has been concluded for the amalgamation of the Compagnie Electro-Mécanique and the Société Anonyme Westinghouse, by means of an interchange of shares. The former, which will make an increase in its share capital for the purpose of absorbing the latter, will then have three groups of works at Bourget, Lyons, and Havre, respectively.

REVIEWS.

Marconi International Code. Vol. I. English, French, Spanish. London: Marconi International Code Co., Ltd. Pp. 575. Price £4 4s.

In "promoting, facilitating and fostering relations between business houses in all parts of the world" codes have played, and will continue to play, a most important rôle. The long catalogues issued by dealers in codes prove that works of this kind abound in great number and cater for many special businesses. Both published and private codes are being continually improved, the ingenuity displayed in gaining economy and in promoting safety being remarkable. Since the introduction of artificial code words there is scarcely an expedient that is not being employed, or has not been discarded, in the interest of safety and simplicity. For these reasons a general code to-day, in order to win a place on the market, must show some distinct advantage or special recommendation when compared with the numerous existing published codes. Several such features are claimed for the Marconi International Code, among which are the saving "in cost of cable charges and cost of time required to code messages"; a condensed method of cabling figures with a "two-letter reliability check"; and a code which translates messages into nine languages, and one which may be employed also for translating foreign correspondence.

The Marconi International Code is published in four separate volumes, each in English and two other languages. Volume I contains English, French, and Spanish. The matter throughout is placed side by side in columns, in the following order: Code number, code word, meaning in English, in French, in Spanish. The arrangement is good, the code words and leading words standing out distinctly.

Each volume is divided into two main portions; one containing a "Numerical System," the other general phrases.

Numerical System.—It is stated that nineteen out of every twenty overseas telegrams contain figures. Whether this percentage is right or wrong, it is certain that safety in the transmission of figures is of paramount importance. Other questions, such as the cost of cabling and simplicity, have also to be taken into consideration in choosing a code.

The method adopted for cabling the figure phrases in the numerical system is the well-known ten-letter code word built up from two-letter tables. The first syllable, consisting of two consonants, represents a phrase, as PH, Rate of exchange; TW, Ship immediately, &c. The second syllable (vowel-consonant) denotes the description of figures, moneys, weights, kilowatts, &c.; the third and fourth, the figures themselves; the fifth, the check syllable.

In striving after economy nearly every two-letter combination is utilised, with the result that, for the sake of safety a check syllable becomes necessary. This is the weak spot in the built-up code word system. A check which has to be worked out for each code word not only adds complications and increases the work of coding and de-coding, but decreases economy to the extent of the check syllable. Provided one consents to waive these disadvantages, and in some cases the small space required for the two-letter table and its suitability for compiling price lists and the like may become the deciding factor, then the question of safety arises, and with ten check figures only the danger is considerable.

In the Marconi numerical system the two-letter syllables are provided with ten check figures (0 to 9). The check figures of the four syllables representing the coded matter are added together and the unit figure only retained as the word check. The fifth syllable then confirms this check figure in the usual manner. Every user of codes is well aware of the mutilations which frequently occur in transit, the more usual ones being caused by the omission, the addition or the changing of a Morse dot or dash, or by a fault in spacing them. Many of the check figures employed in the numerical system under consideration do not appear satisfactorily to combat this danger. For instance, on examining the syllables having the check figure 5 it will be found that 5 represents the following three pairs of similar syllables:—

AB 5 · — — · · ·
AZ 5 · — — — · · **in which a single dot is changed into a dash.**

OF 5 — — — · — ·
OR 5 — — — · — · **in which a dot only has been dropped.**

YG 5 — · — — — — ·
YR 5 — · — — · — · **in which a dash has been changed into a dot.**

All these syllables have the same check figure 5, yet each pair of syllables has a common and usual source of mutilation. The danger is illustrated in the following coded example:

	SN	OM	OF	SE	OR	
Check	6	1	5	3 (1) 5	5	
	Price	Pounds sterling	53	50		Subject to immediate [reply.
	Price	Pounds sterling	63	50		Ditto. ditto.
	SN	OM	OR	SE	OR	
Check	6	1	5	3 (1) 5	5	

It will be observed that these two full ten-letter code words SNOMOFSEOR and SNOMORSEOR have but one letter difference, namely, F and R, and in the Morse code but a

single dot, viz. · · — · and . — . The check figure for both is, however, 5. In the above example the check figure signifies that the correct word has been received, whereas a mere dot can defeat the check syllable and falsify the meaning of the message to the extent of £1,000. The Morse signals for some of the syllables in check figure 5 then are dangerously similar; the other nine check figures have not been fully investigated. All code words containing the syllables AB 5, AZ 5, OF 5, OR 5, YG 5 and YR 5 contain a common source of mutilation, which, should one occur, the check would fail to point out. This is a serious defect, and one that is found more or less in many two-letter systems, though there is one in which this difficulty is met by employing a simple double check which eliminates check syllables in code words.

Phrase section.—The phrase section of the Marconi International Code contains 23,759 words and phrases, 600 figure values, and 2,200 blank code words. The code words in this section are the usual five-letter with at least a two-letter difference, and they therefore require no further check. Each code word is numbered. The pages consist of three columns of matter, the first column in English being arranged in the manner usually adopted in published codes. Columns 2 and 3 contain the French and Spanish equivalents of the English, and all three languages are represented by the same five-letter code word.

The words and phrases, within the range of 23,759 code words, are well selected for general and commercial purposes, but the inclusion of more manufacturing and technical phrases would have proved an advantage. Unfortunately, much of the latter material is combined with the figures in the numerical system already dealt with. There are two pages of figures also in the phrase section, but the numerous gaps in these figures make cabling from them costly.

The outstanding feature of the Marconi International Code is its treatment of foreign languages. The equivalent, where necessary more than one, of each English phrase and word is given in French, Spanish, Italian, Portuguese, Russian, German, Dutch and Japanese, and a common code word conveys the meaning in each of these languages. The English portion of each volume is arranged in alphabetical order, and to facilitate reference an alphabetical index to each language is provided, in which is given the page and code word number of the English meaning. The value of such a work to those who have friends or business connections in foreign lands is obvious. Codes have been published in various languages, it is true; but here we have a carefully selected and comprehensive set of suitably formed phrases by means of which all ordinary social and commercial telegrams, and even correspondence, can be conveyed and automatically translated into the language required.

Volume I also contains many directions for finding the correct word should a wrong five-letter code word be received, and in this connection a terminal index of all the five-letter words employed in the code is to be found at the end of the phrase section.

At the end of the volume is given a valuable comparative table of foreign and colonial units. C. H. C.

Principles of Electric Spark Ignition in Internal Combustion Engines. By J. D. Morgan, M.I.E.E. Pp. 85. London: Crosby Lockwood & Son. Price 8s. 6d. net.

This book is intended for designers, engineers, and students interested particularly in the petrol engine. There are five chapters. The first deals with characteristics of explosive mixtures of air and various gases, curves being given to show the spark energy required to explode certain gases mixed with different quantities of air at atmospheric pressure. The question of the energy required at various pressures is also treated. The pressure-time characteristics are then dealt with in reference to various gaseous mixtures. The effects of turbulence are considered. Experiments are cited in which it is shown that the power obtainable from a petrol engine does not increase with the energy of the spark.

Chapter II is devoted to a discussion of spark characteristics. A description is given of the two forms of spark obtainable, particularly that from the high tension magneto. The author divides the spark into two main components, (*a*) capacity component; (*b*) inductive component, the former being the prime factor in ignition. It is shown that the engine tuner's device of opening out the spark gap results in a larger capacity component, and therefore a spark of higher incendivity owing to the higher voltage necessary to spark the gap. The interaction of spark and gas is treated in Chapter III. The question of the energy required to ignite a given mixture is considered from the point of view of inductance and capacity sparks, and the difficulty in always obtaining the same conditions in a series of experiments is indicated. The ignition of a mixture by a succession of sparks is shown to be a debatable point. Since the book was written Dr. N. Campbell has published results of experiments (*Proc. Phys. Soc.*, 1919) which show that if the first spark fails to ignite a mixture, a succession of sparks of equal intensity will also fail.

A point of considerable interest is the ingenious arrangement for exhibiting the lag in a pressure-time recorder. It is found that the usual pressure-time diagrams, in which a finite interval of time is shown to elapse between the passage of the spark and the rise in pressure in the explosion chamber, are erroneous, due to the insensitiveness of the recorder. The rise of pressure and the passage of the spark are simultaneous. Ignition by means of hot wires and the ionising influence of X-rays is mentioned. This has recently been treated by Dr. Thornton in the *Phil. Mag.*, November, 1919.

Chapter IV is an extremely important one for the user of the internal-combustion engine. The subject matter is concerned with spark plug and test gap characteristics. Chief among the peculiarities of spark gaps is the all-important one of impulse ratio. This term was first adopted by Peek to define the ratio of the oscillatory to the steady voltage required to spark a given gap. The difference is due to a time lag between the application of the requisite voltage and the occurrence of the spark. The variation of impulse ratio with the form of gap, its width and the pressure and temperature of the air are discussed, and an interesting series of curves is exhibited. The function of the third point in magneto and other spark gaps, is shown to be due to a pilot spark which causes ionisation. The effect of the third point is to make the impulse ratio almost constant over a wide range of gap width, without necessitating a large increase in voltage. The annular gap in which the impulse ratio is unity, is described, and the conditions for proper functioning are stated.

In practice considerable difficulties arise with sparking plugs due to defective insulation resulting from sooty deposits and temperature effects. A description of the methods used to cope with disturbing factors of this nature is given. The chief requirement is a rapid rate of rise of voltage to diminish the time available for leakage to take place.

In the fifth and final chapter, there is an account of characteristics of spark generators, *i.e.*, magnetos and induction coils. Reference is made to the classical experiments of Dr. Taylor-Jones which show that the peak voltage of a magneto or an induction coil can be altered by varying the coupling of the primary and secondary circuits. In the same experiments Taylor-Jones showed that the primary condenser was the chief factor in determining the secondary peak voltage, and not the rate of interruption of the primary circuit as appeared from Rayleigh's experiments. Unfortunately with the present type of contact breaker the primary capacity in a magneto cannot be reduced to the optimum value owing to sparking difficulties. In discussing the loss and the energy available in the magneto, the author does not state that only a fraction of the primary energy in the electromagnetic form ($\frac{1}{2}LI^2$) is transferred into electrostatic energy ($\frac{1}{2}CV^2$). This is an important point in connection with the incendivity of the spark. The relative performances at various speeds of magnetos and induction coils are considered, especially from the standpoint of a utility test in which the better generator is that which can cope with the greater plug leakage. In showing that the inductance component of a magneto discharge increases with the speed of rotation, the author omits to mention that the rate of rise of secondary voltage also increases owing to the increased primary current. Since the question of obtaining a spark under adverse leakage conditions depends on the rate at which the voltage is applied, the author's views on the benefits derived from large inductance components cannot be considered as definitely proved. This also applies to the author's remarks at the end of Chapter II.

The book is thoroughly sound both scientifically and practically. It can be recommended with confidence not only to those who are specialists in internal combustion engine and ignition apparatus, but to those who desire a non-mathematical treatment of an extremely important engineering subject. The descriptions of the experiments, many of which have been conducted by the author, and the deductions drawn therefrom are very lucid. A welcome feature, and one we would recommend to all writers of scientific books, is the inclusion of a list of references at the end of each chapter. This is invaluable to those engaged in research work on the subject.

Standard Tables and Equations in Radio-telegraphy. By Bertram Hoyle. Pp. xiv+155. London: The Wireless Press, Ltd. Price 9s. net.

The author aims at producing a book of tables and equations for the use of wireless engineers and others, which shall be more comprehensive than existing works of the kind. He has succeeded in producing a useful looking work in which a feature is made of illustrations of the method of application of the various formulæ and equations by appropriate worked out examples of the more difficult types.

It requires considerable discernment to hit a happy mean in selecting tables, &c., for a book of this character, and it is, moreover, largely a matter of opinion as to what information is appropriate and what should be omitted. We think, however, that such items as the dyne as a unit of force should find a place together with its relation to other units. Maps and charts often find a place of utility in the wireless engineer's impedimenta, but many of the units specially appropriate thereto do not appear.

The information given in the tables should not be taken too strictly in several cases; thus, in a table of dielectric strengths "ordinary" glass is given a definite figure of 8,000 volts per mm. Anyone who has tested different qualities of glass (and other materials) must realise that very wide variations are apt to occur. On the whole, however, we consider that the book will be appreciated, and will fill a useful purpose.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

30,489. "Distributor for ignition circuits of multi-cylinder internal-combustion engines." R. W. SANDERS. December 5th.

30,494. "Thermo-electric couples." C. E. FOSTER. December 5th.

30,495. "Electric motor controllers." C. R. GALER. December 5th.

30,509. "Electric arc lamps." H. B. GRYLLS and W. HEAPE. December 5th.

30,513. "Electric gas-filled lamps with glow discharge." F. SCHRÖTER. December 5th. (Germany, April 14th, 1916.)

30,520. "Electric resistance heater for melting furnaces." SOC. ANON. DES ATELIERS DE SECHERON. December 5th. (Switzerland, December 28th, 1918.)

30,534. "Electrical water-heating apparatus." FILBAR ELECTRIC HEATER, LTD., and C. KRAFT. December 6th.

30,539. "Rotors of squirrel cage induction motors." HIGGS BROS. and W. F. HIGGS. December 6th.

30,568. "Electric lamps." H. E. BLAKE and H. SLATER. December 6th.

30,584. "Mouthpieces of telephones, &c." J. JOFEH. December 6th.

30,588. "Voltage control of electric generators and motors." BRITISH THOMSON-HOUSTON CO. and F. H. CLOUGH. December 6th.

30,604. "Ignition devices for internal-combustion engines." W. J. COLE and TELEGRAPH CONDENSER CO. December 6th.

30,608. "Electric safety fuses." S. J. KNUDSEN. December 6th. (Denmark, March 8th.)

30,654. "Electric animated photo-telegraphy." C. L. COLLINS and A. E. MORRISON. December 8th.

30,674. "Amplification of electrical effects resulting from action of light on selenium cells." G. W. WHITE. December 8th.

30,680. "Electric locomotives." Sir J. A. F. ASPINALL. December 8th.

30,681. "Electrically-heated irons." R. WEAVING. December 8th.

30,691. "Aerial electric conductors and supports for same." E. A. CLARKMONT and W. T. GLOVER & Co. December 8th.

30,694. "Electrically-operated pumps." J. H. OSBORNE. December 8th.

30,695. "Electrically-operated pumps." A. W. BURFORD and J. H. OSBORNE. December 8th.

30,702. "Electric bells." A. VERNON and J. VERNON. December 8th.

30,744. "Balancing voltages in three-wire direct-current systems by means of static balances." R. D. ARCHIBALD. December 9th.

30,745. "Direct-current dynamos." A. E. GLANVILL. December 9th.

30,771. Distributors, &c., for electric current for use with internal-combustion motors, &c." J. H. RUNBAKEN. December 9th.

30,792. "Magneto coupling." F. J. LORD and R. A. TAYLOR. December 9th.

30,797. "Controlling devices for electrically-wound clockwork, &c." FABRIK ELEKTR. APPARATE F. SAUTER. December 9th. (Switzerland, December 24th, 1918.)

30,799. "Circuit-interrupting devices." F. W. LE TALL (Westinghouse Electric & Manufacturing Co.) December 9th.

30,800. "Signal-transmitting mechanisms." WESTERN ELECTRIC CO. December 9th.

30,843. "Thermionic amplifiers." H. J. ROUND. December 9th.

30,851. "Electrical engine-starting devices." S. T. HENN and RUSHMORES, LTD. December 9th.

30,857. "Electric burglar alarm fitted to locks." C. TOWNLEY. December 9th.

30,868. "Electrical static machines and apparatus for electro-therapeutic work, &c." T. CLARK. December 9th.

30,881. "Automatic electric-light switches." H. B. VOGEL. December 10th.

30,908. "Annunciator for offices, warehouses, &c." G. GARSCADDEN. December 10th.

30,922. "Protective devices for alternating electric current systems." METROPOLITAN-VICKERS ELECTRICAL CO. and J. B. PALMER. December 10th.

30,926. "Junction, &c., boxes for electric conductors." R. S. O'NEIL. December 10th.

30,941. "Devices for securing electric fittings, &c." E. A. CLAREMONT and G. H. SCHOLES. December 10th.

30,943. "Dynamo-electric machines." D. SUCHOSTAWER. December 10th.

30,957. "Apparatus for obtaining variable speeds in alternating-current motors." G. FARATORE. December 10th. (Italy, December 11th, 1918.)

30,961. "Electrical signalling apparatus for railways." H. A. BULL. December 10th.

30,970. "Automatic telephone systems." D. S. HULFISH. December 10th. (United States, December 8th, 1917.)

31,002. "Electro-magnetic engines or motors." H. F. MORDEY. December 11th.

31,005. "Wireless telegraphy systems of the arc-gap type." L. T. BARKER. December 11th.

31,014. "Electric motors." W. BROWN and G. H. ROWLEY. December 11th.

31,045. "Holders or containers for electric-heating elements." J. A. COLQUHOUN. December 11th.

31,057. "Sparking plug." G. E. T. ARCHER, F. O. ELLIS and S. E. TAYLOR. December 11th.

31,059. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG, and G. PEGG. December 11th.

31,064. "Wireless telegraphy, &c." S. BRYDON. December 11th.

31,066. "Apparatus for electro-static deposition of particles from gases." E. BURY and SKINNINGROVE IRON CO. December 11th.

31,067. "Socket fittings for pin-and-socket connectors for electric circuits." H. F. MCLOUGHLIN, SIMPLEX CONDUITS, LTD., and L. M. WATERHOUSE. December 11th.

31,088. "Electrical coils and manufacture thereof." H. WADE (Coto-Coil Co.). December 11th.

31,103. "Methods of distribution on alternating-current systems." A. M. TAYLOR. December 12th.

31,155. "Electrically-heated thermo-siphon radiators." G. MONTE. December 12th.

31,164. "Ignition systems." DAYTON ENGINEERING LABORATORIES CO. December 12th. (United States, December 22nd, 1917.)

31,169. "Electric sparking plugs." P. C. GROSJEAN. December 12th. (France, November 14th, 1918.)

31,180. "Means for driving magnetos for motor vehicles and controlling ignition thereof." C. ROOME. December 12th.

31,182. "Spring driving belts for speedometers, fans, lighting dynamos, &c." L. E. SITZLER. December 12th.

31,199/200. "Apparatus for electrically controlling railway trains, &c., through the track." A. R. ANGUS. December 12th. (Sweden, October 10th, 1917.)

31,205. "Dynamo-electric machines." H. CHITTY. December 12th.

31,214. "Recording and re-producing sound and telephony." A. F. SYKES. December 12th.

31,220. "Electrically-propelled road vehicles." P. A. MOSSAY. MOSSAY & CO., and RANSOMES, SIMS & JEFFERIES. December 12th.

31,302. "Foot appliance for applying electricity to the body." E. RICHARDS. December 13th.

31,253. "Storage battery cells, &c." D.P. BATTERY CO. and J. WADDELL. December 13th.

31,262. "Variable cut-off for electrical installations." L. A. GOW. December 13th.

31,263. "Electric miners' lamps." E. E. GARDNER. December 13th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

16,017. APPARATUS FOR HEATING LIQUODS ELECTRICALLY. G. Bellaviti. November 2nd, 1917. (135,225.)

1918.

14,646. MAGNETO-ELECTRIC IGNITION MECHANISM FOR INTERNAL-COMBUSTION ENGINES. Splitdorf Electrical Co. January 2nd, 1918. (121,942.)

15,614. ELECTRIC WATER-HEATER. L. E. Seimbille. January 28th, 1918. (122,814.)

16,673. CURRENT-REGULATING DEVICES FOR ELECTRICALLY-HEATED CRUCIBLES, RETORTS, MUFFLES, MELTING FURNACES, AND THE LIKE. Morgan Crucible Co. and C. W. Spiers. October 12th, 1918. (135,237.)

16,784. ELECTRIC WELDING APPARATUS. R. F. Woodburn. October 15th, 1918. (135,238.)

17,053. ELECTRIC WELDING MACHINES. British Thomson-Houston Co. (General Electric Co.) October 18th, 1918. (135,244.)

17,174. RADIO-TELEGRAPHY. L. M. Cockaday. October 27th, 1917. (120,570.)

18,601. ELECTRICAL SWITCHES. W. H. Sullivan and H. J. Dean-Osgood. March 18th, 1919. (135,255.)

18,713. TIMING-RINGS AND TIMING-LEVERS OF MAGNETOS OR IGNITION DEVICES. British Lighting and Ignition Co. and A. E. Bennett. November 14th, 1918. (134,937.)

18,740. ELECTRIC SWITCHES OR CIRCUIT INTERRUPTERS. W. B. Dale and Metropolitan-Vickers Electrical Co. November 15th, 1918. (135,260.)

18,759. ELECTRICAL HEATERS. Benham & Sons and C. R. Allensby. November 5th, 1918. (134,941.)

18,760. ROTARY ELECTRICAL SWITCHES. E. L. Rankin. November 15th, 1918. (134,942.)

18,763. AUDIBLE WARNING OR SIGNAL DEVICES OF THE VIBRATORY DIAPHRAGM TYPE. J. F. Monnot and E. T. Cook. November 15th, 1918. (135,264.)

18,780. ELECTRO-MAGNETIC LOCK-OUT SWITCH. Igranic Electric Co. (Cutler Hammer Manufacturing Co.) November 13th, 1918. (135,265.)

18,802. ELECTRIC SWITCHES. R. W. Bill. November 16th, 1918. (134,946.)

18,892. DYNAMO-ELECTRIC MACHINES. N. C. F. Jenson and M. J. E. Tilney. November 18th, 1918. (134,952.)

18,934. MAGNETICALLY-OPERATED MOTOR-CONTROLLING AND LIKE SWITCHES. H. W. Cox and J. H. Cowell. November 19th, 1918. (134,954.)

18,955. AUTOMATIC TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) November 19th, 1918. (135,282.)

19,146. ALTERNATING CURRENT ELECTRIC ARC CUTTING AND WELDING APPARATUS. C. J. Holslag. September 21st, 1918. (133,013.)

19,147. ELECTRIC ARC WELDING AND REPAIRING. C. J. Holslag. June 11th, 1918. (128,186.)

19,154. MECHANISM FOR AUTOMATICALLY AND PERIODICALLY OPERATING FURNACE OR OTHER VALVES, ELECTRIC SWITCHES, OR THE LIKE. J. Horn. November 21st, 1918. (135,297.)

19,234. INTER-COMMUNICATION TELEPHONE SYSTEMS. J. W. Dungey and T. P. Wingfield. November 22nd, 1918. (135,302.)

19,305. MAGNETOS FOR INTERNAL-COMBUSTION ENGINES AND THE DRIVING PROVISION THEREFOR. R. S. Whalley. November 23rd, 1918. (135,308.)

19,323. COMBINED ELECTRIC LIGHT FITTING AND CEILING FAN. M. J. Railing and H. W. Roberts. November 23rd, 1918. (134,971.)

19,340. TIME LAG DEVICES FOR ELECTRIC AUTOMATIC SWITCHES AND OTHER ELECTRICAL APPARATUS. F. C. Fuke and New Switchgear Construction Co. November 22nd, 1918. (135,311.)

19,404. ELECTRICAL CONTACT MAKERS FOR USE WITH THE STEERING WHEELS OF MOTOR VEHICLES. J. L. Scott. November 25th, 1918. (Cognate application 4,162/19.) (134,973.)

19,756. ELECTRODES OF ELECTRIC FURNACES. Soc. Electro-Metallurgique Francaise. December 3rd, 1917. (121,282.)

20,525. MAGNETIC CHUCKS. W. Arter. September 10th, 1917. (Divided application on 12,961/17.) (135,000.)

21,229. CONSTRUCTION OF CONTACT-BREAKERS FOR MAGNETOS. E.I.C. Magnetos, Ltd., and W. T. Turner. December 19th, 1918. (135,012.)

21,308. INSULATORS FOR HIGH-TENSION ELECTRIC CABLES. H. Wade. (Fabbrica Isolatori Livorno.) December 19th, 1918. (135,057.)

21,506. ELECTRIC ARC LAMPS OF THE ENCLOSED PROJECTOR TYPE. Westminster Engineering Co. and A. G. Way. December 23rd, 1918. (Addition to 9,225/10.) (135,020.)

21,610. INCANDESCENT ELECTRIC LAMPS SUITABLE FOR AUTOMOBILES AND THE LIKE. Butlers, Ltd., and A. Reeves. December 24th, 1918. (135,351.)

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864. ELECTRIC SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. A. R. Kahl. (A. A. Radtke.) January 13th, 1919. (135,031.)

1,344. SPARKING PLUGS. J. A. Moreau. January 18th, 1919. (135,042.)

2,193. ELECTRIC FUSES FOR BLASTING. W. L. Rowe, J. F. Smith and S. Holland. January 29th, 1919. (135,379.)

2,517. APPARATUS FOR GRINDING COMMUTATORS FOR ELECTRIC MOTORS AND THE LIKE. J. Phillips. January 31st, 1919. (135,057.)

2,656. ELECTRICALLY-OPERATED BELLS OR SIMILAR SIGNALLING APPARATUS. A. Bagutti. February 3rd, 1919. (135,000.)

2,962. IRON CORES FOR ELECTRIC TRANSFORMERS, INDUCTANCES, AND THE LIKE. J. S. Mollerhoj. February 6th, 1918. (123,096.)

3,247. ELECTRIC ARC LAMPS. H. B. Grylls and W. Heape. February 10th, 1919. (135,066.)

3,645. PROTECTIVE DEVICES FOR ELECTRICAL CIRCUITS. Western Electric Co. (Western Electric Co.) February 14th, 1919. (135,389.)

3,665. DYNAMO-ELECTRIC GENERATORS. V. Crabb. February 14th, 1919. (135,073.)

3,685. ASCERTAINING THE DISTANCE OF THE SOURCE OF SOUNDS IN SUBMARINE SIGNALLING AND THE LIKE. A. W. Sarnmark. February 14th, 1919. (123,327.)

4,342. ELECTRIC MOTORS FOR VARIABLE SPEED TRANSMISSION. H. H. Wright and T. Humphreys. February 21st, 1919. (135,392.)

4,982. SOCKETS FOR ELECTRIC LAMPS. J. Wegmann. June 18th, 1918. (128,538.)

7,606. METHOD OF AND ARRANGEMENTS FOR COOLING HIGH-SPEED DYNAMO ELECTRIC MACHINES. M. Gruber. March 26th, 1919. (135,409.)

8,581. RADIO-TELEGRAPHIC TRANSMISSION SYSTEMS. W. J. Mellersh-Jackson. (A. Taylor.) April 4th, 1919. (135,111.)

8,798. ELECTRICAL DEVICE FOR HEATING LIQUIDS. W. B. Smits. April 5th, 1918. (125,392.)

9,411. IMPULSE SENDING DEVICES APPLICABLE TO AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) April 14th, 1919. (135,416.)

10,038. SPARK-PLUG INDICATORS. C. F. Pinneo. April 22nd, 1919. (135,116.)

10,942. ELECTRICAL GENERATORS AND ELECTRIC MOTORS. J. Shepherd. May 2nd, 1919. (135,122.)

11,312. PROCESS FOR MANUFACTURING PURE ELECTROLYTIC COPPER FROM CEMENT COPPER. A. G. Sundberg and T. E. Thomasson. May 6th, 1919. (135,125.)

11,570. PROJECTOR ARC LAMPS. Johnson & Phillips and G. C. Pearson. May 8th, 1919. (135,127.)

13,503. ELECTRIC CHAIN-WELDING MACHINES. G. J. Armstrong. May 28th, 1919. (135,136.)

13,512. DISTRIBUTOR DEVICES FOR IGNITION APPARATUS. Remy Electric Co. April 4th, 1917. (Divided application on 219/19.) (127,587.)

14,757. ELECTRIC CIRCUIT-CONNECTING DEVICES. J. Glasson. June 11th, 1919. (135,438.)

15,555. AUTOMATIC SIGNAL BUOY AND AUTOMATIC WIRELESS TRANSMITTER MECHANISM. W. E. Sanson. June 20th, 1919. (135,441.)

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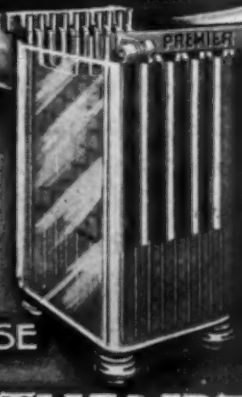

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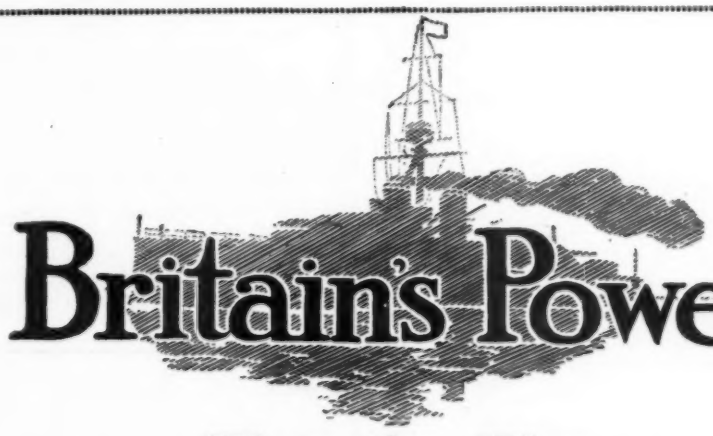

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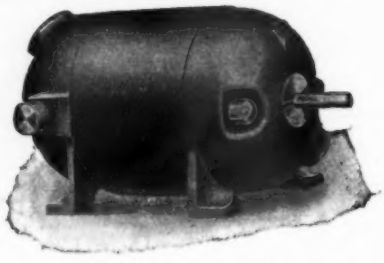

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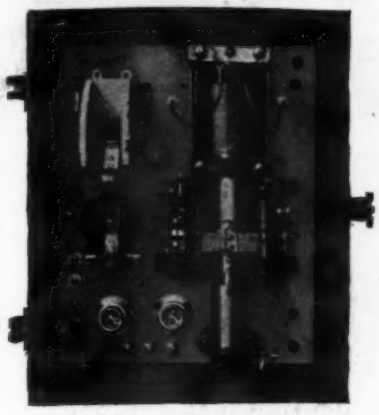

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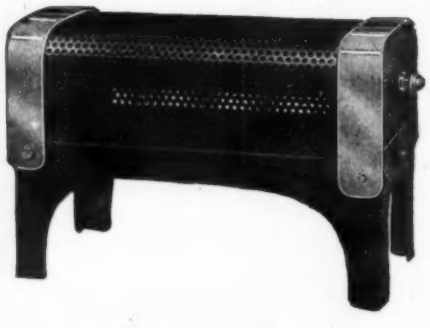

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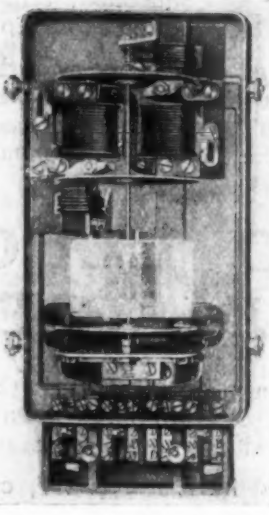

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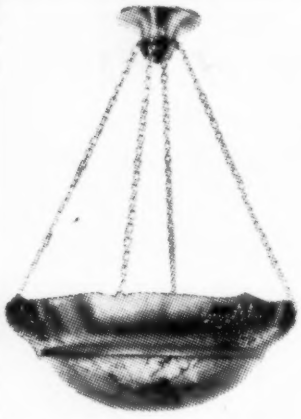

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A Merry Christmas

And may every reader of "The Electrical Review," every customer of ours, past, present and prospective—share in that merriment and find therein a joyful pause in the arduous round of every-day activities.

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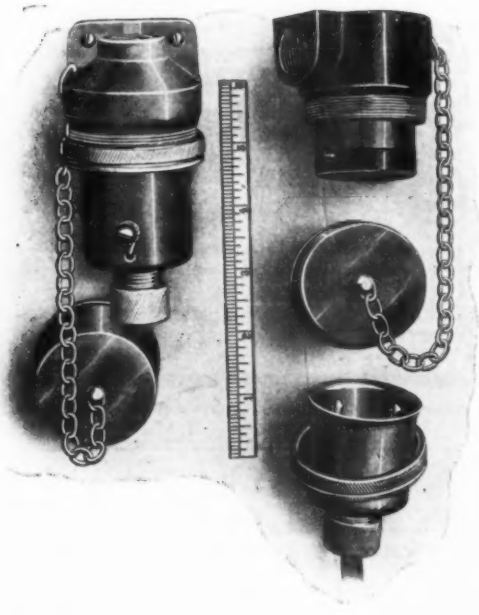

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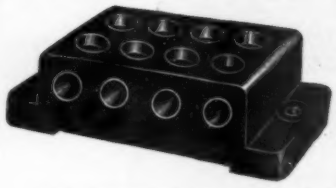

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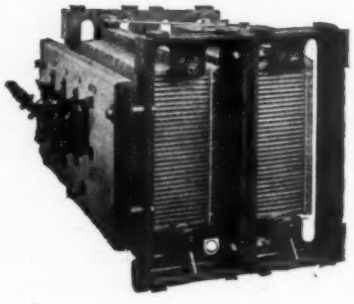

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Highest possible efficiency, embody all the desirable features which we have found to be necessary in our long experience as manufacturers of this class of instrument for the Admiralty and all the leading engine makers, &c.

Beautifully finished in Hard Black Stove Enamel, with Nickel-plated Mountings. Horizontal and Vertical Patterns, in 4, 6 and 8-inch Dials.

Fig. 5149
"B.B." Type Gyrometer.

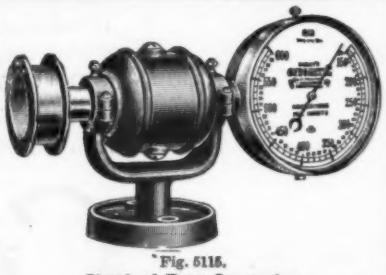

Fig. 5115.
Standard Type Gyrometer.
(As made for the Admiralty, &c., in large numbers.)

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by detecting and eliminating waste in your steam, water and air systems with the reliable assistance of

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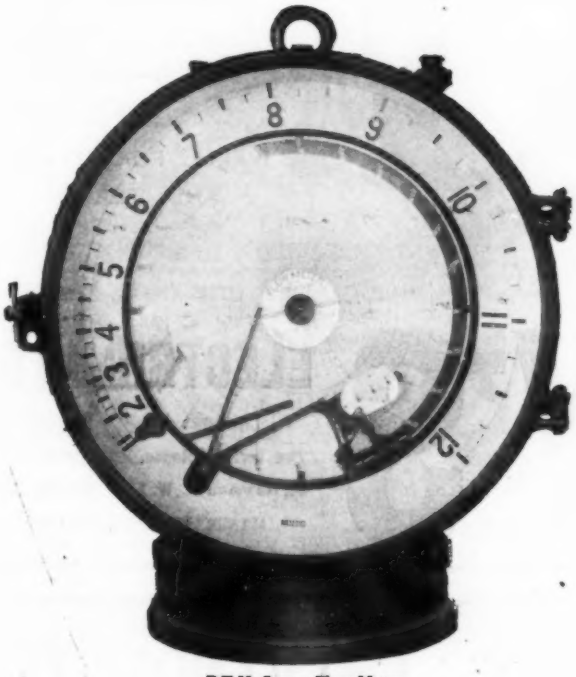

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EASILY REPLACEABLE ELEMENT.

SPECIAL CONNECTOR TAKING STRAIN ON FLEXIBLE.

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The scale is 2·35 inches in length, is uniformly divided, and is calibrated 30—0—30.

The resistance of Model 375 Galvanometer is approximately 29 ohms. The current required for a millimetre (1 scale division) deflection is 20—25 micro-amperes.

With 1 volt a deflection of 1 millimetre (1 scale division) will be obtained through 62,500 ohms, but as a deflection of 0·2 of a scale division can be readily detected, the Galvanometer is, in reality, serviceable through 302,500 ohms.

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Voltages 100/440.
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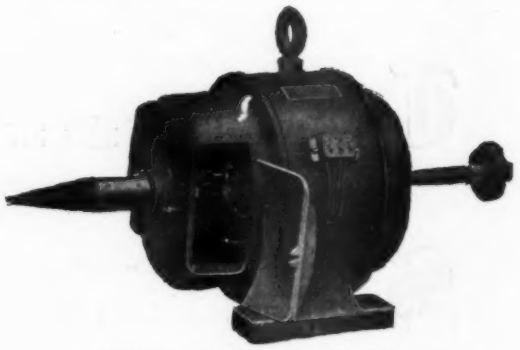

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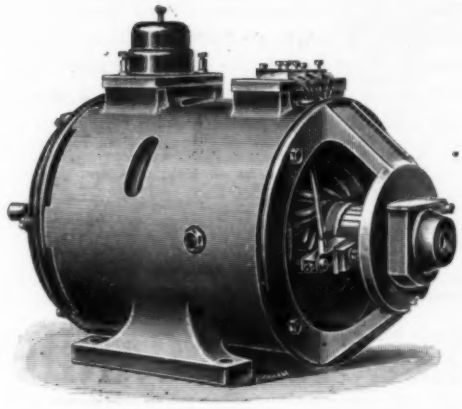

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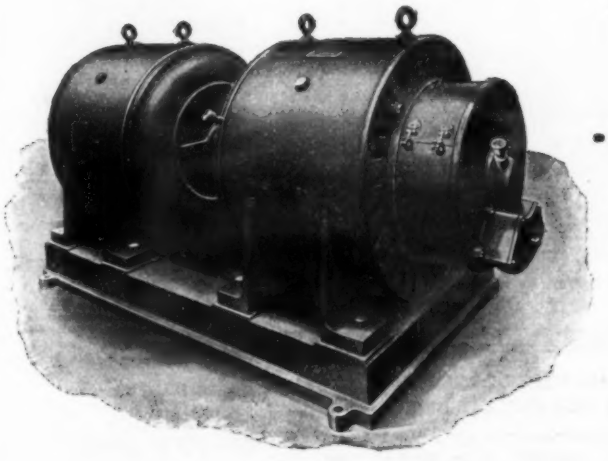

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[The following information is published in the interests of electrical contractors and others who are seeking for openings for new business. Considerable expense is incurred in the production of this column, and every care is taken to ensure that the information is new and accurate, but it will be understood that in a matter where so many correspondents are engaged, and where the amount of information to be handled is very large this cannot always be guaranteed. If alleged inaccuracies are reported to the Editors, they will be fully investigated.]

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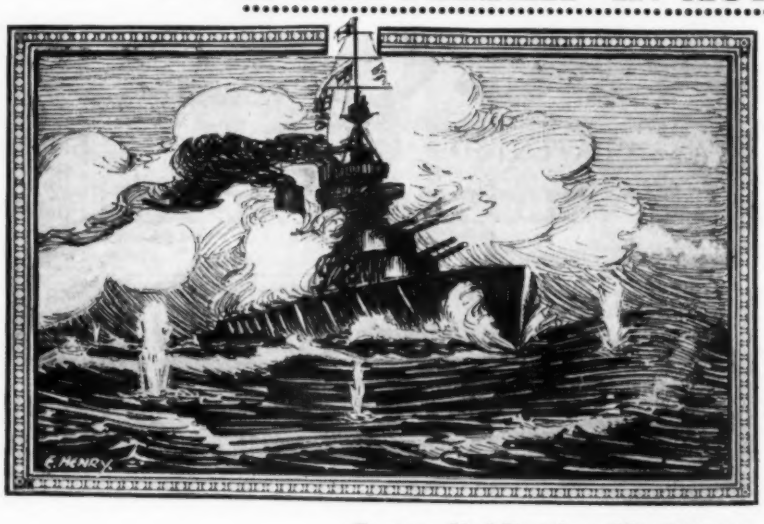

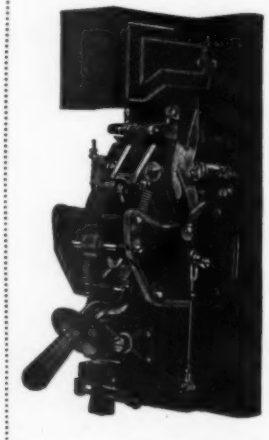

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THE ADMIRALTY MUST HAVE THE BEST——THAT'S WHY THEY SELECTED OURS.
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Telegrams: "Switches," Castleton, Lancs.

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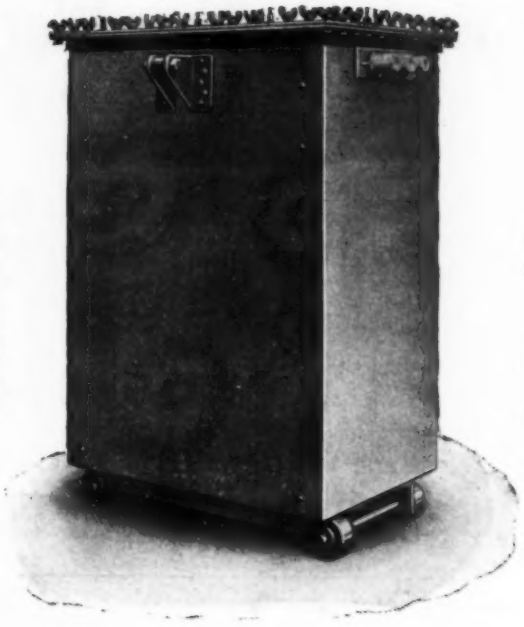

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OUTPUT:
At 600 v., 50 periods
—255 leading k.v.a.

DIMENSIONS:
2′ 6″ × 3′ 9″ × 5′ 10″ HIGH.

Weight 2 Tons.

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Motor Insulation made Oilproof.

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INSULATING VARNISHES

add to the strength of insulation and protect it from damp, oil, and also from the action of acid fumes. For machines working in oily situations they are invaluable.

Write us your Requirements and ask for List.

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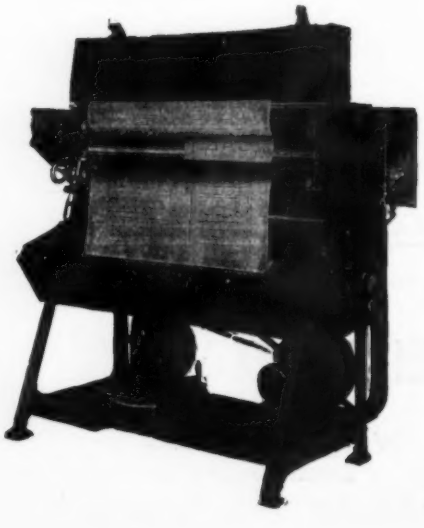

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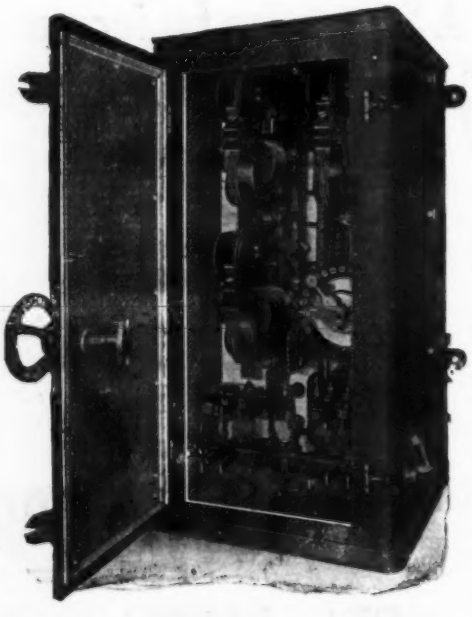

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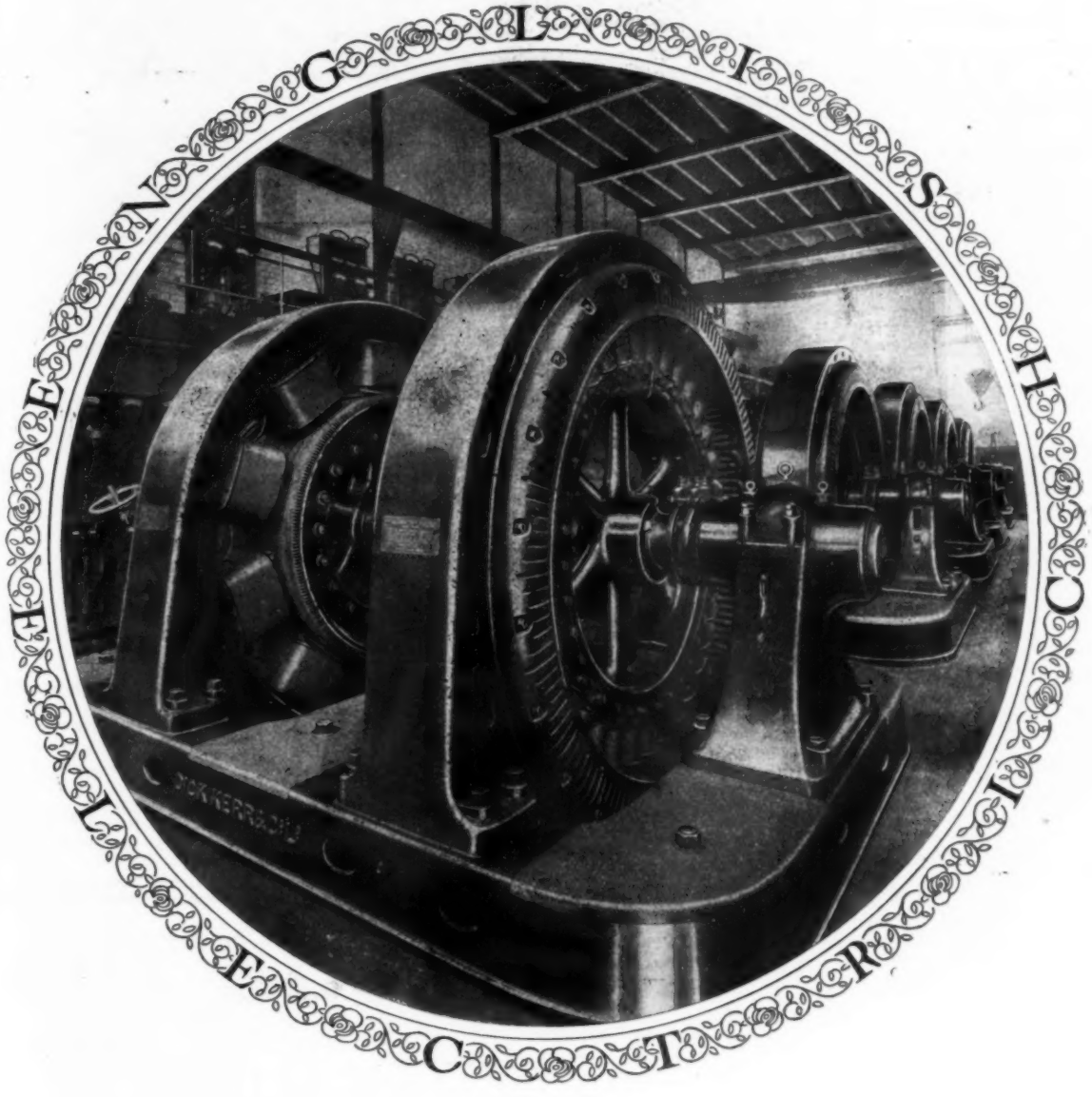

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(Continued on page xxxvi.)

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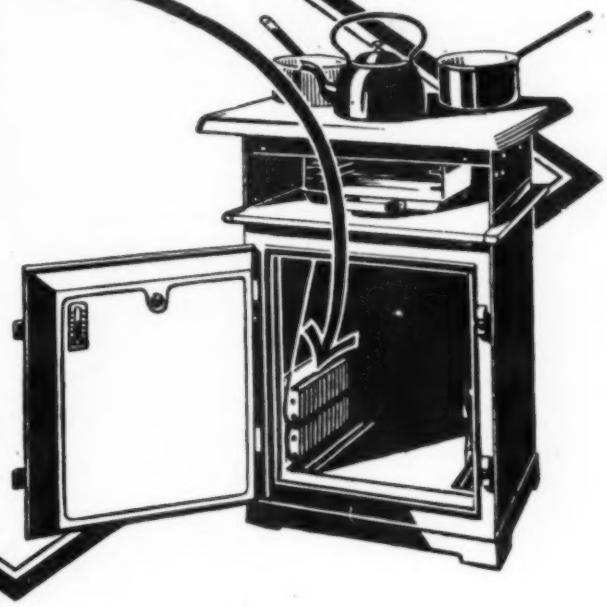

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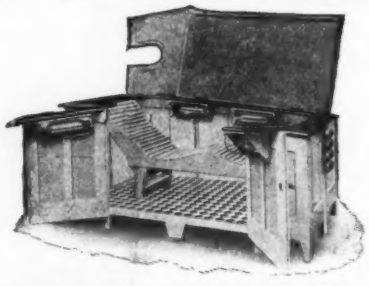

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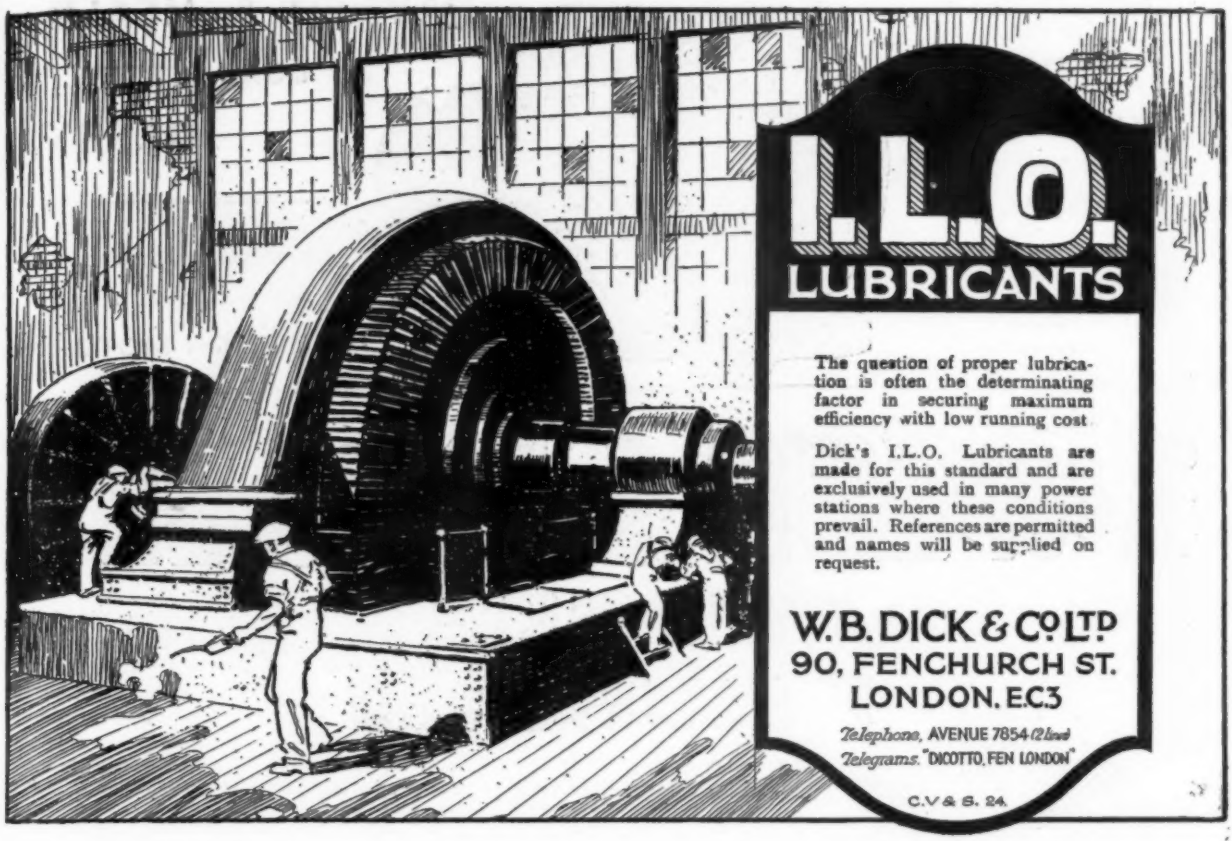

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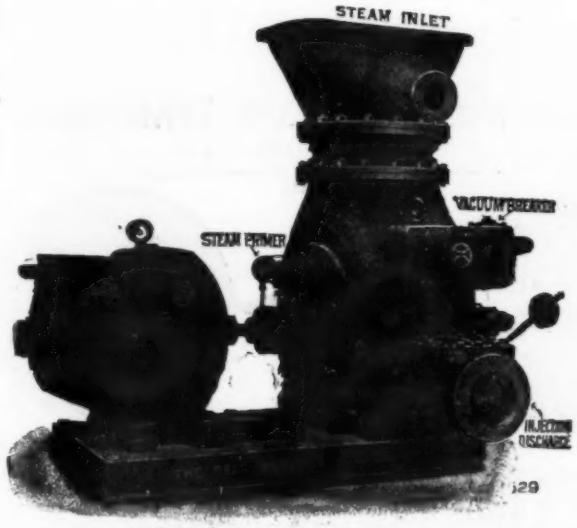

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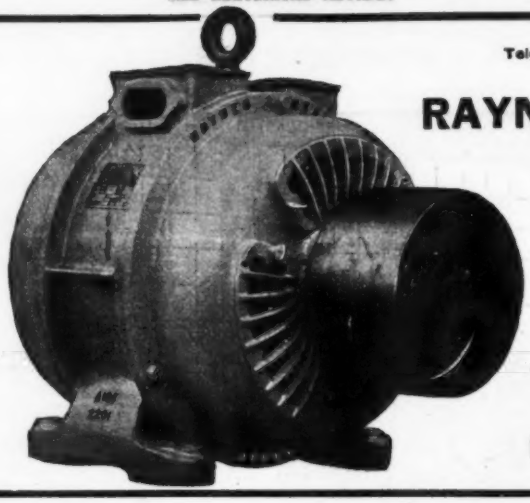

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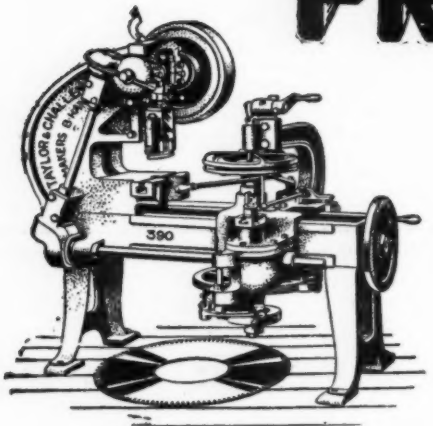

390 NOTCHING PRESS.

This press accurately slots Armature Core Plates in a rapid and economical manner. Adjustment of saddle for different diameters of circles to be notched does not disturb the connections either of the dividing mechanism, locking slide, or automatic clutch control.

T. & C., Ltd., have complete appliances for supplying customers with accurately cut dividing wheels, with any number of teeth, at a moderate cost to fit their notching presses.

FOR

Cutting and pressing armature plates, pole pieces, dust covers, bearing frames, switchgear, turbine blades, lighting set details, lamps, insulators of composite material and other

ELECTRICAL

components where large quantities are required and where die pressed work is advantageous. Wherever possible

ENGINEERS

are now designing electrical details for manufacture under presses in preference to casting and machining, as articles manufactured from rolled sheet metal are found to be more efficient weight for weight, and have the advantage of the original rolled metal surface undisturbed by any machining.

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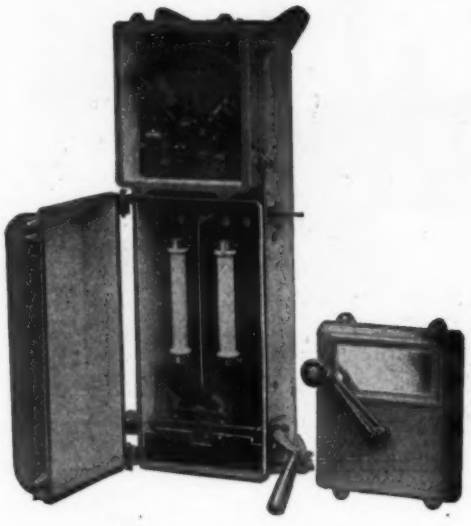
VERITYS LTD

ENGINEERS,

WORKS: ASTON, BIRMINGHAM.



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Specially suitable for mounting direct on machine tools, or where space is limited.

Pedestal Ammeters fitted on the top when required.

Fuses can be either Handle Pattern (as shown) or Home Office Bridge Pattern.

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Sizes: ¼—10 H.P., 100—500 volts.

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A. 118.

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The movement is of extremely simple construction and a positive action is obtained in the initial opening and closing of the switch.

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SWITCHES . . ACCESSORIES . . IRONCLAD GEAR . . SWITCHGEAR

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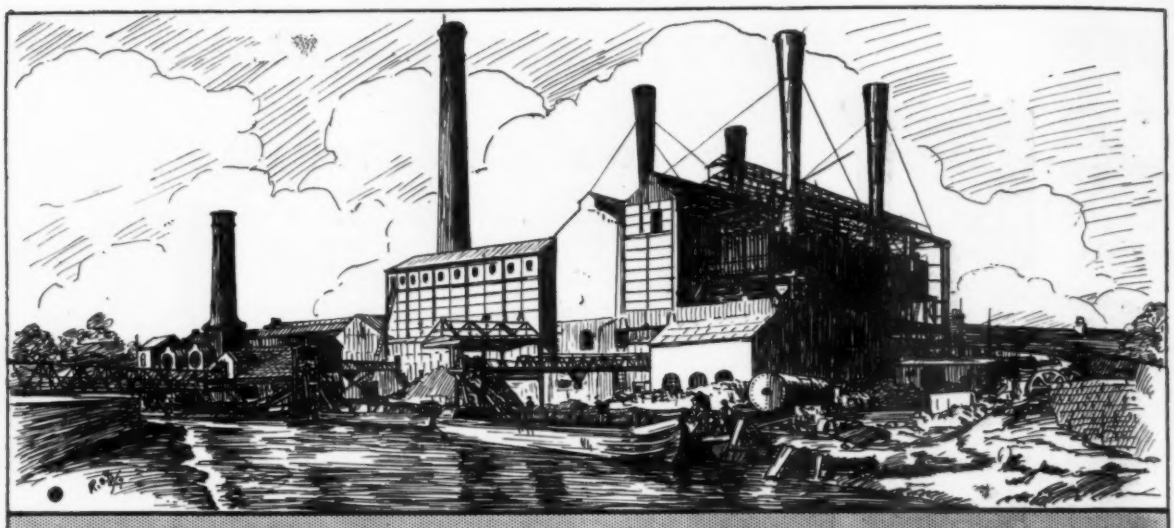

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ACID, OIL AND FOOL PROOF.

"GUARDIAN"
PATENT
SAFETY HAND LAMPS
TO COMPLY WITH
HOME OFFICE REGULATIONS.

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ADOPTED BY THE LEADING ENGINEERING FIRMS, SHIPYARDS, CORPORATIONS & GOVERNMENT DEPARTMENTS.

LIST No. 104 ON REQUEST.

In spite of various imitations still pre-eminent

A feature of these Hand Lamps is their strong construction, the guards being made up of heavy gauge wire, strongly galvanized after making. The supporting strap on the "Guardian" Lamps is held by fibre pegs, and bound by soldered non-rusting tinned wire.

"GUARDIAN," Type G1 (as illustrated). Hand Lamp, complete with heavy Guard and Holder. **8/9** each.

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Flexible.
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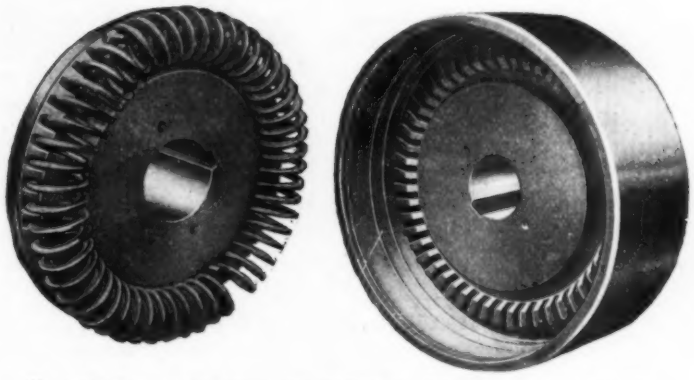
Balanced for High Speeds.



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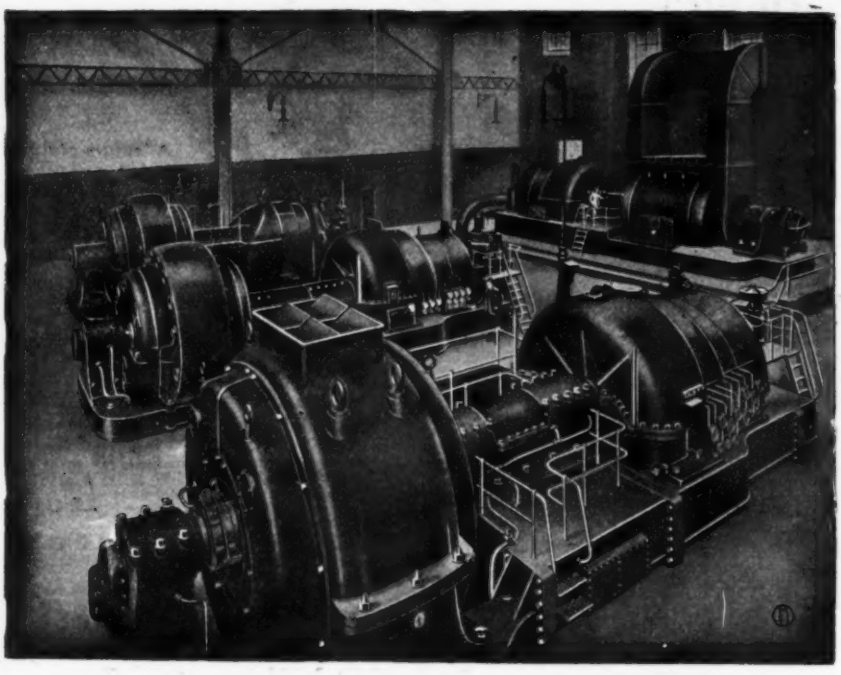

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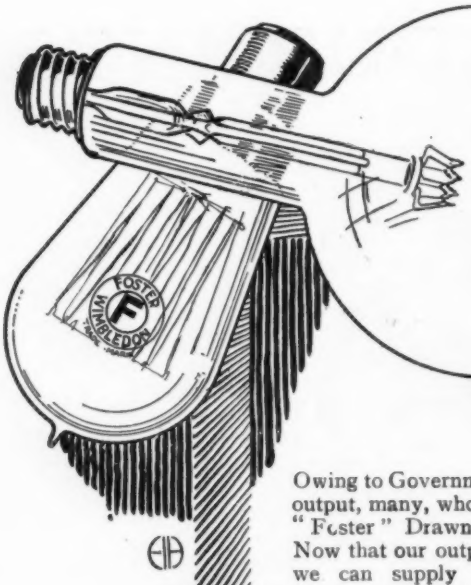

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½ WATT & 1 WATT TYPES

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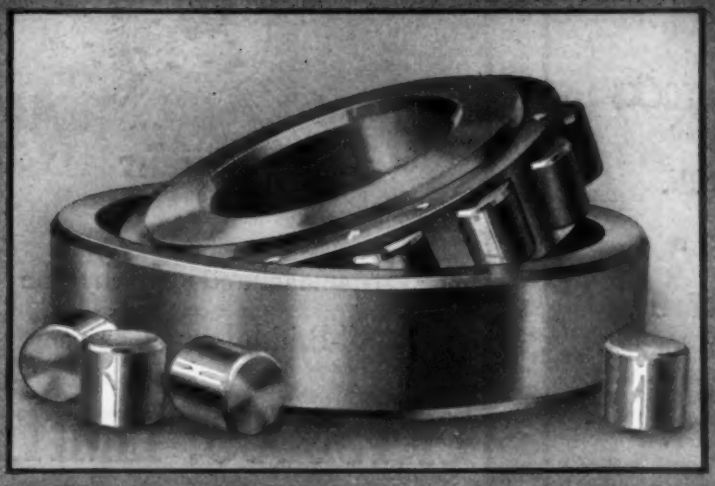

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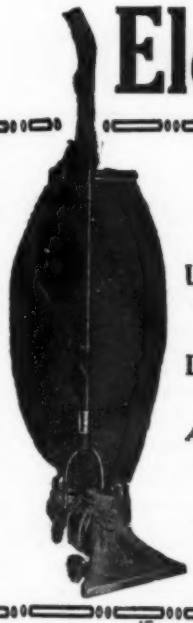
Electric Vacuum Cleaners



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Large Stocks.

An Investment for any Home.

50 Volts to 250 Volts.

∴ ∴ *Enhance your Reputation* by supplying Vacuum Cleaners ∴ ∴ of Proved Merit.

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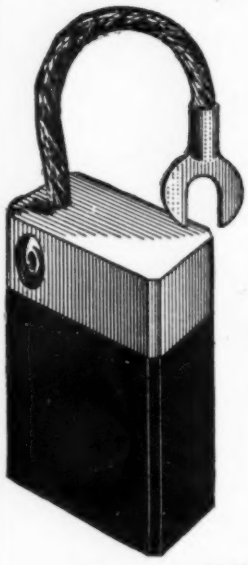

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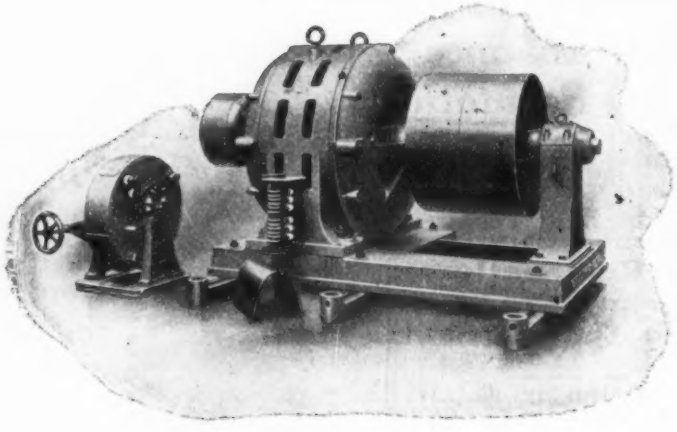

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GLOWING RED HOT BARS OF QUARTZ MAKE A ROOM COSY.

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"THERMAGLO" FIRES ARE PLEASING TO THE EYE.

PRICES:

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1500 to 3000 watts consumption.

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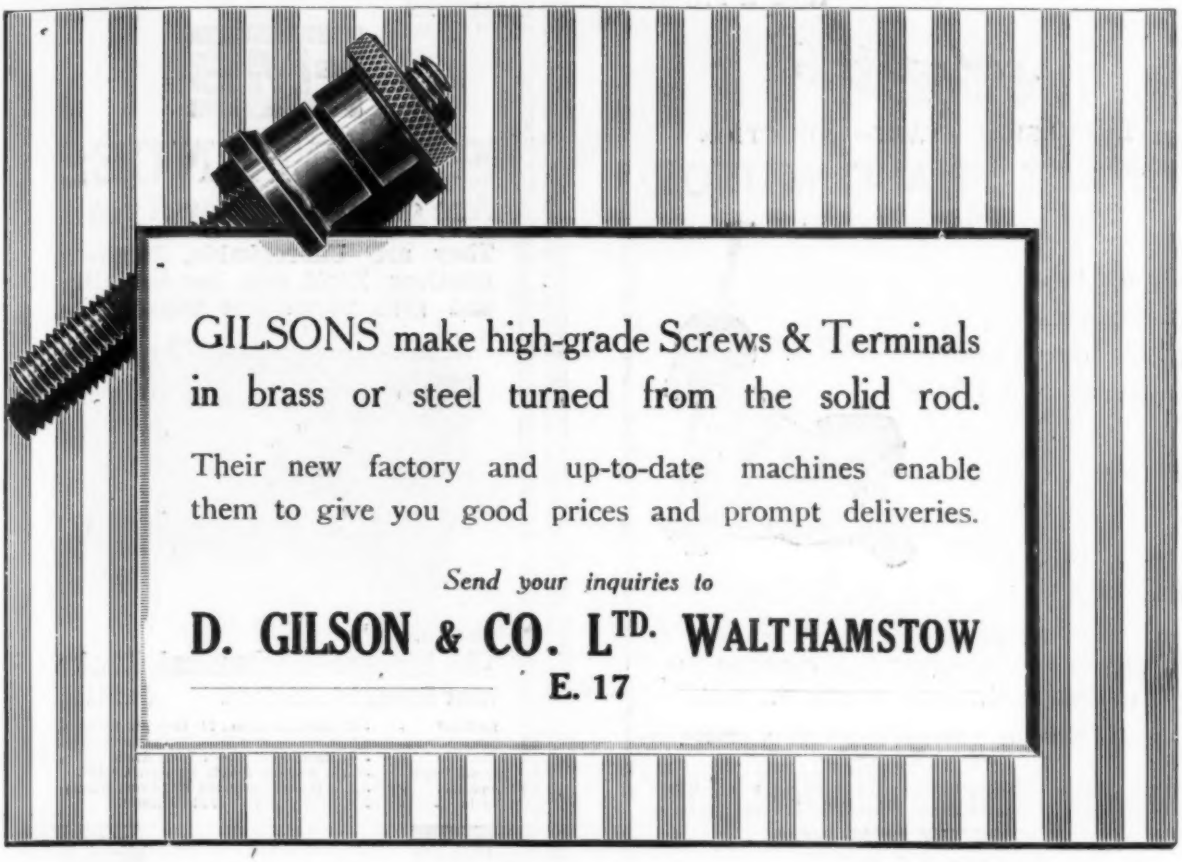

GILSONS make high-grade Screws & Terminals in brass or steel turned from the solid rod.

Their new factory and up-to-date machines enable them to give you good prices and prompt deliveries.

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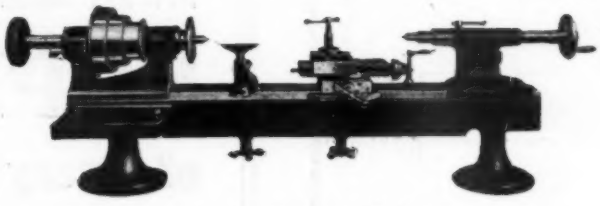

These machines are built throughout with that detailed accuracy requisite in such lathes, and you will find them capable of answering the most exacting demands.
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Various attachments can be added to meet extra demands.
This Precision Lathe is especially suitable for Instrument, Jewellery and Electrical manufacturing where the finest accuracy is required.

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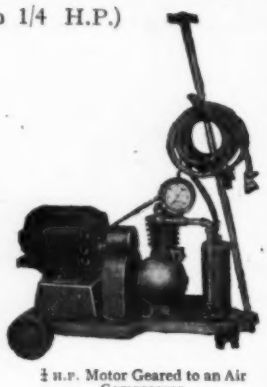
SINGLE-PHASE MOTOR

(1/10 to 1/4 H.P.)

so as to protect it when carrying full load—and that fuse will usually be of ample capacity to enable it to successfully start full load.



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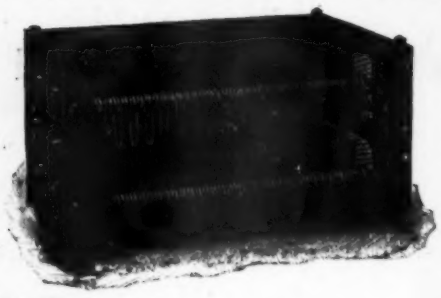
They are Unbreakable, Jointless, Rustless, Rigid and Non-inductive, and give permanent satisfaction.



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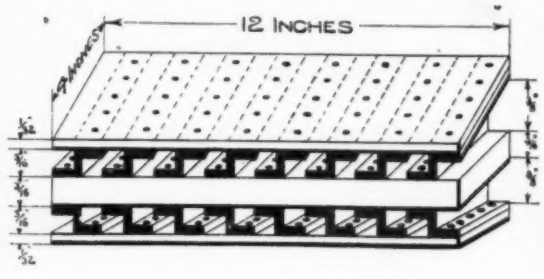

It took **300** minutes to drill and punch holes and to rivet this job.

The same piece of work was done upon our Spot Welding Machines in **8** minutes, the power consumption being ·61 kw. hours.

Saving effected: 292 minutes labour and 150 rivets.

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British made in Rugby, England

Lighting advice free.

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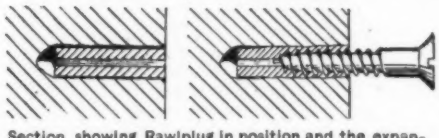
For FIXING SCREWS IN PLASTER, BRICK, CONCRETE, MARBLE, SLATE, STONE, CEMENT, METAL, Etc.



Section showing Rawlplug in position and the expansion of the plug against the side of the hole.

R eliable and efficient.
A nyone can use them.
W ill hold over half-a-ton.
L ow cost.
P revents damage to walls.
L eaves no marks.
U nsightly Wood Blocks abolished.
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A full description of the methods employed in the radiography of welded steel plates, thick and thin iron and aluminium castings, wooden structures, &c., with reproductions of radiographs showing the detection of small faults.
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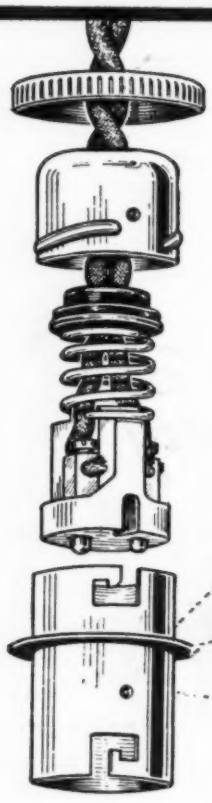

Simplicity

NOTE THIS

Explanatory View showing the internal construction of the "Improved-way" LESCO Lampholder.

is the distinguishing characteristic of the modern "improved way"

LESCO

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Lampholder

(HOPE'S PROV. PATENTS)

—a simplicity which makes for highest Economy, because all the complicated and tedious fitting operations of the "old way" are entirely removed, substituted by the simple, safe and dependable "LESCO" way. Note its simplicity features:—

Has a single REVERSIBLE Shade Locking Ring OUTSIDE, which is rapidly and securely fixed in position by a single turn.

No LOOSE Screwed Shade Rings to bother with, and no screw threads to get crossed and stripped.

A REAL Cord Grip which needs no cutting away and will withstand a pull of 60 lbs.

Easily and quickly assembled, remarkably efficient, and saves 50% in wiring time.

Makes a better and more reliable contact. Pressure is uniform and never varies.

An ALL-BRITISH Product—manufactured throughout at the Fluvent Electrical Works at Congleton, Cheshire.

DELIVERIES FROM STOCK.

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HOPE'S PATENT

Fluvent

REGD. TRADE MARK

IRONCLAD, THREE-PHASE AND DOUBLE-POLE FUSE BOXES

constitute the Safest and most Economical system for HEAVY SHORT CIRCUITS because they are built throughout of Standard Units, in which all parts are easily renewable—will always clear circuit under the most severe short-circuit conditions—minimise the difficulty of spares—eliminate all heating troubles, and are designed with all live parts exceptionally well shielded.

FLUVENT Fuse Boxes comply in every respect with Home Office Regulations and are only half the weight and size of "ordinary" Fuse Boxes.

Note the FLUVENT Fuse Features:—

Very short break. Compact size. Watts loss less than one-fifth of that in other makes. Mass of metal volatilised on short circuit less than one-thirtieth of that in any similar type of fuse. Fuse wire passing through small hole to contact prevents over-fusing. Blowing effect of tube tends to blow arc away from contacts instead of towards them. No portion of fuse wire is in direct contact with the china at any point. Lining of fuse chamber is indestructible and will withstand 3000 deg. Cent.

Fullest information and details gladly furnished on request. Deliveries for Urgent Orders from 7 to 10 days if desired.

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Hulme Electrical Works, MANCHESTER.

London Office: 25, Victoria Street, S.W.1. Scotland: A. C. Borthwick, 149, St. Vincent St., Glasgow.
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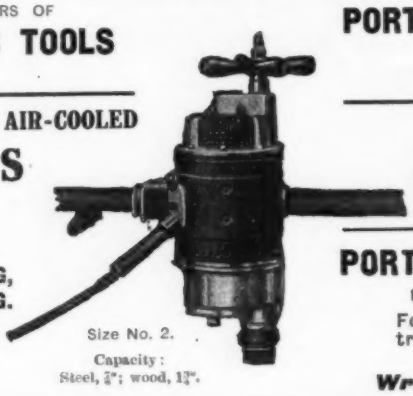
THE CONSOLIDATED PNEUMATIC TOOL CO., LTD.

THE LARGEST MANUFACTURERS OF
PORTABLE ELECTRIC TOOLS
FOR ALL PURPOSES.

'LITTLE GIANT' HEAVY DUTY AIR-COOLED
ELECTRIC DRILLS and GRINDERS
FOR
PORTABLE DRILLING, REAMING, TUBE EXPANDING and GRINDING.
WOUND for all CURRENTS and VOLTAGES
Designed to withstand the heavy overloads incidental to hard and continuous work without damage.



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PORTABLE ELECTRIC DRILLS,
made in various sizes,
capacities $\frac{3}{16}$" to 2" in metal.

MACHINES FOR
Engineers, Shipbuilders,
Iron Founders, Motor Car Builders,
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PORTABLE ELECTRIC BLOWER,
DIRECT AND ALTERNATING CURRENT.
For cleaning the windings of Electrical Machinery and Switchgear.

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HEAD OFFICES:
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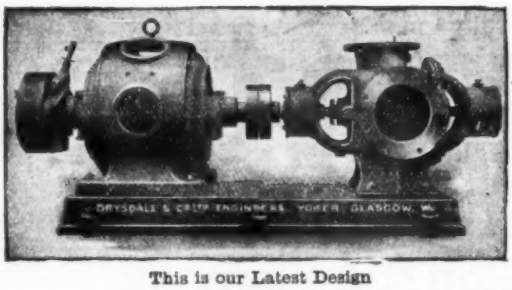
CENTRIFUGAL PUMPS
For Coal Washing, Circulating, &c.



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LOW LIFT and MEDIUM LIFT
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It Embodies Several New Features, we shall be glad to have Your Enquiries.

DRYSDALE & CO., LTD., Yoker, GLASGOW, W.

The Lusty Lung, with all his might
The praise is sung to friend Fluxite.

Electricians, Plumbers, Gasfitters and other Metal Workers all sing the Praises of

FLUXITE

as the paste flux that solders even dirty metals without cleaning or corrosion, and joints lead without solder merely by the use of a blow-lamp or blow-pipe. In short, Fluxite

SIMPLIFIES SOLDERING
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If desired some solder can be filed into a little Fluxite and the two applied together. Fluxite is a necessity in every tool-kit.

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Of Ironmongers and Oilshops, in Tins, 8d., 1/4 and 2/8.

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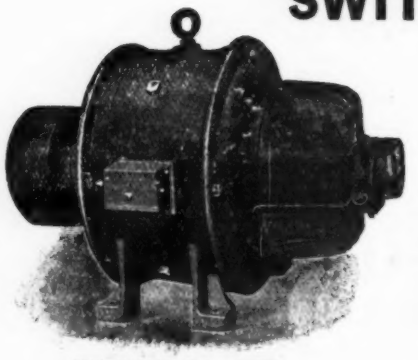
DYNAMOS AND MOTORS.
SWITCHBOARDS.

Notice the **BALL BEARINGS.**



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A Sterling CHRISTMAS

TO ALL OUR FRIENDS we extend our heartiest greetings for a real old-fashioned Christmas—laden with good cheer, good things and goodwill.

It has not been possible, during the past five years, to enjoy such treats, hence our sincere wish that you one and all make up for lost time and cause this Yuletide to be memorable as a happy return to the ancient Sterling British method of celebrating Christmas.

Sterling Telephone & Electric Co. Ltd.

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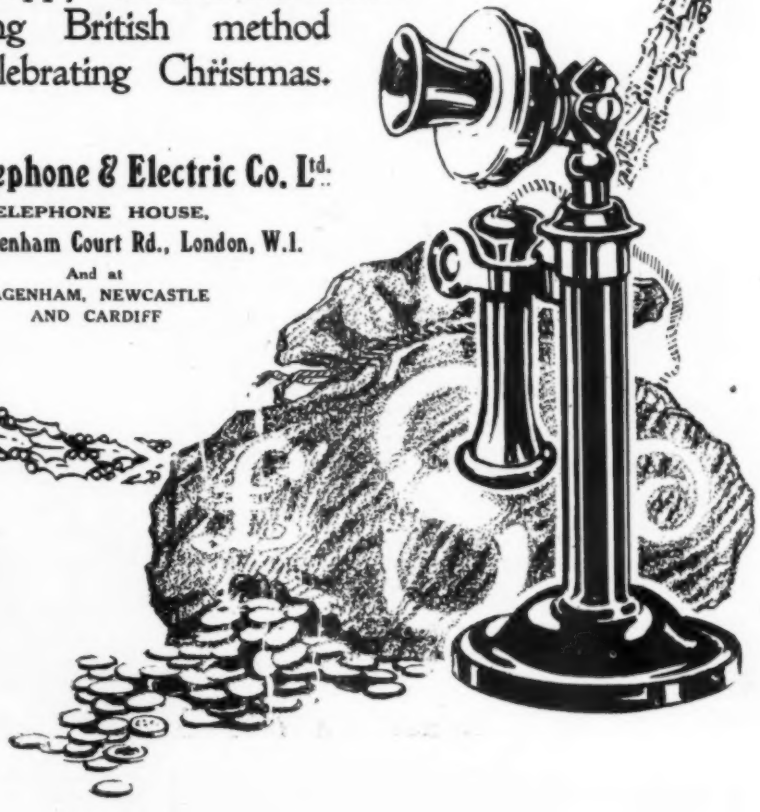
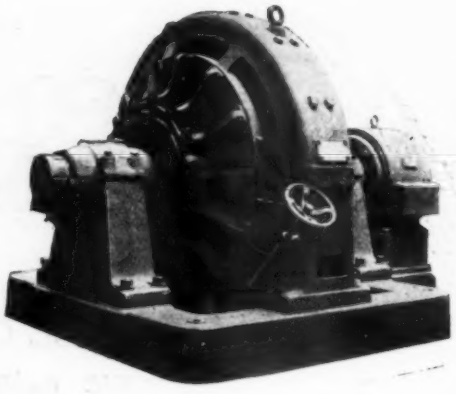
210-212, Tottenham Court Rd., London, W.1.
And at
DAGENHAM, NEWCASTLE
AND CARDIFF



G.E.C. Electrical Plant

To every contract undertaken by the G.E.C. is brought a long and varied experience of electrical work in all its phases. Standard tests, rigidly applied throughout the various stages of manufacture, ensure perfect results. G.E.C. Electrical Plant has gained an unrivalled reputation among power users throughout the world.

The unsurpassed manufacturing facilities of the Company's Works at Witton, near Birmingham, and its association with Fraser & Chalmers Engineering Works, Erith, Kent, enable complete contracts to be undertaken for Electrical Plant (Lighting, Power and Traction).



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THE GENERAL ELECTRIC CO., Ltd.,

Head Office: **67, Queen Victoria Street, London, E.C. 4.**

Engineering Works . . . Witton, near Birmingham . . . . . .

Fraser & Chalmers Engineering Works, Erith, Kent.

Branches throughout the United Kingdom, and in all the principal markets of the world.

Fraser & Chalmers' Steam Turbines (Rateau Type)

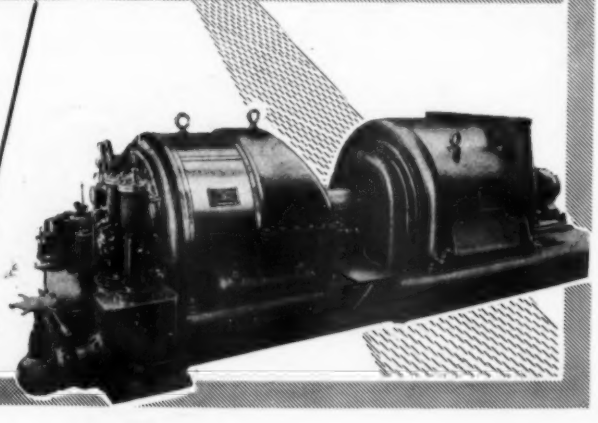
Fraser & Chalmers were the pioneers of High-speed Steam Turbines.

F. & C. Steam Turbines are all of the Rateau type, and are adaptable to any steam supply.

HIGH, LOW, MIXED, BACK-PRESSURE & PASS-OUT TYPES.

Standard sizes of production from 500 KW. to 30,000 KW., supplied complete with Generators.

TURBO-BLOWERS. TURBO-COMPRESSORS.



FRASER & CHALMERS ENGINEERING WORKS

ERITH, KENT

SPECIAL NOTICE.

OFFICIAL NOTICES, PATENT NOTICES, SITUATIONS VACANT, SITUATIONS WANTED, PARTNERSHIPS, AGENCIES, ARTICLES FOR SALE, ARTICLES WANTED, ETC.

Latest Time 5 p.m. WEDNESDAY.

¶ *New Copy and Alterations to Existing Trade Advertisements (with Blocks) should reach here*

Not later than FRIDAY.

ELECTRICAL

PARTNERS and PARTNERSHIPS

can be obtained through

WHEATLEY KIRK, PRICE & CO.

(Established 1850).

46, Watling Street, London, E.C.

15, Albert Square, Manchester. 26, Collingwood Street, Newcastle-on-Tyne.

SITUATIONS VACANT.

Latest time for receiving, 5 p.m. Wednesday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

ASSISTANT TELEGRAPH ENGINEER.

ASSISTANT TELEGRAPH ENGINEER required for the Government Posts and Telegraphs Department, Federated Malay States, for three years' service, with possible permanency. Salary £360—£15—£480 per annum, with a duty allowance of £75 per annum, and a war bonus of 30% on salary. Free passages. Candidates age 24 to 30, preferably single, who must possess a thorough technical knowledge and good practical experience of all systems of telegraphy, line construction and maintenance, including surveying and estimating for new lines, laying, maintaining and testing all classes of telegraph and telephone cables, and installing and maintaining magneto lamp-signalling and common battery telephone exchange systems, should apply at once (by letter), giving brief details of age and experience to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/F.M.S. 9448.

7984

COUNTY BOROUGH OF PORTSMOUTH.

Electricity Supply Department.

APPLICATIONS are invited for the position of Charge Engineer. Salary £110 (rising to £130 by two annual increments), plus 20 per cent., and £90. Applicants should be capable of taking control of men, and be familiar with Boiler-house supervision and the running of Turbo Alternators. Applications, endorsed "Charge Engineer," stating age, and giving particulars of technical training and experience, should reach the undersigned not later than JANUARY 5th, 1920.

B. HANDLEY, A.M.I.E.E.

Electricity Works,
Gunwharf Road, Portsmouth. 7922

WANTED FOR NORTHAMPTON AND WELLINGBOROUGH.

TWO CABLE JOINTERS. Used to services and all classes of low-tension mains work.—Apply, giving age, experience, wages required, and enclosing copies of testimonials, to The Northampton Electric Light & Power Co., Ltd., 25, Bridge Street, Northampton. 7959

SITUATIONS VACANT.—*Continued.*

SUNDERLAND CORPORATION ELECTRICITY DEPARTMENT.

Meter-Room Superintendent.

METER ROOM SUPERINTENDENT wanted. Applicants must be competent to undertake the maintenance, testing, and calibration of all electrical instruments in use on an E.H.T. 3-phase, and L.T., D.C. system; the testing of consumers' installations dealing with queries relating to consumers' accounts, and to keep all records relating to the above. Salary at the rate of £156 per annum, plus 20 per cent., plus £90, total £277 per annum.

Applications, stating age, present post, details of training and experience, and enclosing copies of testimonials, to reach the undersigned not later than DECEMBER 24th, 1919.

A. S. BLACKMAN.
Borough Electrical Engineer.

Dunning Street,
Sunderland. 7875
December 10th, 1919.

THE UNIVERSITY OF SHEFFIELD.

Faculty of Engineering.

APPLICATIONS are invited for the post of ASSISTANT LECTURER AND DEMONSTRATOR IN ELECTRICAL ENGINEERING. Salary £300 per annum, including evening work. Candidates should be Graduates of a British University.

Applications, stating particulars of training and experience, accompanied by three testimonials, and giving the names of three referees, should be received not later than JANUARY 5th next, addressed to the Dean of the Faculty of Engienering, the University, Sheffield.

W. M. GIBBONS,
Registrar.
7975

PLUMBER-JOINTER.

PLUMBER-JOINTER required by large Electricity Supply Undertaking in East London. Only those with experience of lead-covered paper-insulated underground cables need apply. Preference will be given to man used to 2- or 3-phase H.T. and L.T. feeders. Standard Trade Union wages paid.

Apply ENGINEER AND MANAGER, 84, Romford Road, Stratford, E. 15. 7968

ASSISTANT WANTED.

WANTED, Assistant for small Generating Station. Must have had previous experience of D.C. three-wire system with batteries, and preferably knowledge of Diesel engines.

Applications, containing full particulars of experience, copies of references, and wages required, should be sent to ELECTRICAL ENGINEER, Town Hall, Sale. 7967

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE wanted for Generating Station in Midlands. Applicant must have had experience with E.T.H., 3-phase turbo-alternators, water-tube boilers, and D.C. 3 wire. Commencing salary £4 per week.

Apply, giving full particulars of past experience, stating age, whether married or single, with copies of experience, to 7960, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(Continued on next page.)

SITUATIONS VACANT.—*Coatinued.*

LONDON COUNTY COUNCIL.

THERE is a vacancy at the L.C.C. school of Engineering and Navigation, High Street, Poplar, E., for a whole-time Teacher of Electrical Engineering and Physics for the Day Technical School and the Evening Classes. Experience in practical engineering, laboratory work and class teaching is desirable. The candidate selected will be required to take up his duties after Easter, 1920.

Commencing salary £225 to £315 a year according to qualifications and experience, rising by yearly increments of £15 to £330, thence by £10 increments to £440 a year.

Preference will be given to those persons who have served or attempted to serve with His Majesty's Forces.

Application forms may be obtained from the Education Officer (T. 1), Education Offices, Victoria Embankment, W.C. 2 (stamped, addressed foolscap envelope necessary). Forms must be returned by 11 a.m., JANUARY 12th, 1920. Canvassing disqualifies.

JAMES BIRD,
Clerk of the London County Council.

December 19th, 1919. 7994

DONCASTER CORPORATION ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the position of Chief Clerk. Applicants must have a sound knowledge of book-keeping, and be competent to analyse and to tabulate accurately Works Costs.

Commencing salary at the rate of £200 per annum (inclusive).

Applications, stating age, present post, and setting out concisely particulars of training and experience, and enclosing copies of testimonials, to reach the undersigned not later than FRIDAY, JANUARY 9th, 1920, endorsed "Chief Clerk."

S. R. WINDLE,
Borough Electrical Engineer.

Grey Friars Road,
Doncaster,
December 23rd, 1919. 8020

THREE SHIFT ENGINEERS.

WANTED, to take charge of the running plant in a Liverpool factory and to undertake any small repairs when necessary. Applicants will require to have mechanical, boiler-house and electrical experience and be accustomed to the control of men.

The salary will commence at £260 per annum, rising by £10 yearly to £300.

Particulars of experience and age to be forwarded, not later than 16th JANUARY, to—

8019, ELECTRICAL REVIEW.
4, Ludgate Hill, London, E.C. 4.

CHARGE ENGINEER.

CHARGE ENGINEER wanted, with experience in a modern E.H.T. power station of 5000-KW. capacity. Must have had experience with Westinghouse-Fraser & Chalmers turbo-alternators. Man with steel works experience preferred. Salary £5 per week of 47 hours.

Apply, giving full particulars of training and experience, to LEYLAND MOTORS, LTD., Leyland, Lancashire. 1008

CABLE JOINTER.

CABLE JOINTER required for North-East Municipal Station. Must have experience in the laying and jointing of three-core armoured and lead-covered cable and the laying of services. Wages, including all bonuses to date, £4 8s. 4d.

Applications, giving full particulars, to 8005, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PLUMBER-JOINTER.

PLUMBER-JOINTER required for Corporation in Scotland, accustomed to E.H.T. and L.T. paper-insulated cables.

Write, stating experience and wages required, to—

7992, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

CABLE JOINTER.

WANTED, Cable Jointer.—Municipal Electrical Department, near Manchester, requires good man used to plumbed joints. Wages £4 7s. 3d. (47 hours).—Address, giving full particulars, to—

8022, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C.4.

SITUATIONS VACANT.—*Continued.*

BOROUGH OF NUNEATON.

APPLICATIONS are invited for position of Meter Tester. Must be experienced in the repair and calibration of C. and H., and Ferranti ordinary and prepayment Meters.—Apply, stating wages required, and when at liberty to commence, to the Borough Electrical Engineer, Electricity Works, Nuneaton. 8021

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

Yorkshire Electric Power Co., Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

ALL ENGINEERS, before accepting any position on the Staffs of either of the above undertakings, are recommended to communicate with the undersigned.

W. ARTHUR JONES,
65-66, Chancery Lane, *General Secretary.*
London, W.C. 2. 6666

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

APPRENTICE Wanted. Electrical Engineers, London. Good training and prospects.—879, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders, used to D.C. work, wanted in London works; Winders used to A.C. work also required. Good wages and permanent position for first-class men.—5823, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winders wanted, first-class men. Full rate and piecework.—Rees Roturbo Manufacturing Co., Ltd., Wolverhampton. 7879

ASSISTANT Engineer required by small Supply Co.; good electrical and mechanical experience (preferably gas engines) essential.—Apply, stating experience and salary required, to 1002, ELECTRICAL REVIEW, Ludgate Hill, London.

ASSISTANT for electrical and heating engineers' stores with knowledge of electrical accessories and steam and hot water fittings. State age, experience, references, salary.—F. Webb and Son, Electrical and Heating Engineers, Leicester. 1010

CONTROL-Room Attendant wanted for E.H.T. power house. Three-phase experience essential. Inclusive salary, £4 15s. per week of seven 8-hour shifts.—7788, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN for A.C. winding drawings and diagrams.—Write, stating qualifications, age and salary required, to Electrical D.O., The B.T.H. Co., Ltd., Rugby. 8002

DRAUGHTSMAN wanted:—(*a*) for the design and detail of rolling stock for electric and light railways and the like, preferably with workshop experience; (*b*) for the design and detail of control gear and wiring for electric rolling stock; and (*c*) for the layout and arrangement of engineering workshop plant, machinery, tool and general stores, &c.—Write, stating age, experience and salary required to Box No. 40, Anderson's Advertising Agency, 14, King William Street, Strand. 8012

DRAUGHTSMAN wanted for switchgear design. State age, experience, salary.—7981, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN.—An electrical manufacturing firm in Manchester district are in need of a few Electrical Draughtsmen, preferably with experience of the design of oil switches, circuit breakers and other types of switchgear apparatus. Fully qualified men only should apply. Permanencies.—Full particulars to 7883, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMEN.—Wanted, by firm in Manchester district, Mechanical Draughtsmen for electrical department. Experience of transformer work an advantage. Permanencies.—State age, details of previous experience and salary required, to 7775, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(Continued on next page.)

SITUATIONS VACANT.—*Continued.*

ELECTRICAL contractors have vacancy for Assistant Branch Manager, near London. Previous experience on country house work essential. Salary £250, commission and motor-cycle allowance.—Full particulars of experience, age and copies of references, to 8023, ELECTRICAL REVIEW, 4, Ludgate Hill, London. Ex-service man preferred.

ELECTRICAL Engineer required by a manufacturing firm in the East of Scotland. Applicant to have technical and practical experience of A.C. and D.C. generators and motors and general plant maintenance. State age, experience and salary required, and earliest date when free. Applications will be treated in confidence.—Apply Box 686, Robertson & Scott, Advertising Agents, Edinburgh. 7983

ELECTRICAL Engineer wanted by London firm to design and superintend electrical manufacture of D.C. Generators, three KW. and up, for direct coupling; also later D.C. and A.C. Motors. State experience and salary required, when available.—8015, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL WIREMEN, wanted immediately for screwed tubing and general work. Must be men with first-class experience. Rate (inclusive) 1s. 11d. per hour. State experience, age, &c.—The Warrington Electrical Co, Ltd., 82, Sankey Street, Warrington. 7970

ENGINEER required for supervision of telephone duct and cable contracts in the provinces. Salary £5 per week and allowance. State qualifications and experience.—7980, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

EXPERIENCED Sales Engineer. Electrical Manufacturers want an experienced Sales Engineer to take charge at home of export sales work. An attractive and important position requiring the combination of sound commercial and technical experience. Applicants must be capable of taking entire charge of office staff and dealing with complete tenders. Applications must state age, salary desired and particulars of candidate's education, including technical training and commercial experience.—7951, ELECTRICAL REVIEW, Ludgate Hill, London.

FOREMAN Armature Winder required, with up-to-date experience in D.C. winding; also several Armature Winders required, experienced in winding D.C. motors up to 10 H.P.—Reply, stating experience, to 7972, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN Required for Light Engineering Machine Shop in London, must thoroughly understand how to keep machines, capstans, presses, and tools in first rate order, and get maximum output. No application will be considered unless it states age, full details of training, and experience, including names of past employers, dates of joining and leaving, and salary expected.—859, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GLASSBLOWERS required, used to electric lamp making, for South-West district of London; high wages paid and bonus.—Apply by letter, giving full particulars, to 7945, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GOOD opening for experienced Female Armature Winder as Chief Assistant in West London winding room engaged on small A.C. and D.C. motors.—Reply, stating experience in detail and salary required, to 8003, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GOOD Wiremen and Charge Hands wanted immediately, used to country house work.—Apply, stating wages required and giving full particulars of experience, to Edwards & Armstrong, Ltd, Cainacross, Stroud. 7792

INSTRUMENT Maker required for telephone inspection, having good knowledge of all classes of telephones, bells, &c. Good permanent position for suitable man.—Write, giving fullest details, to I., Box 265, Sell's Advertising Offices, Fleet Street, E.C. 4. 999

JUNIOR Assistant required for London office of H.T. and L.T. switchgear specialists. Drawing office and estimating experience necessary. Good prospects.—Write Ferguson, Pailin, Ltd., 37, Norfolk Street, Strand, W.C. 2. 1004

LANARK County Council.—Second Cable Jointer required, accustomed jointing two and three-core armoured cables, and experienced in connecting services and meters. Wages 85s. 3d., 47-hour week, inclusive of all awards.—Apply by letter, stating age and experience, and enclosing copies two recent testimonials, to The Resident Engineer, Electricity and Destructor Works, Bothwell Street, Cambuslang, N.B. 1017

SITUATIONS VACANT.—*Continued.*

MECHANICAL Inspector required. One used to all kinds of press work for telephone and electrical apparatus.—Write, giving fullest details, to M., Box 266, Sell's Advertising Offices, Fleet Street, E.C. 4. 1000

REQUIRED at once, first-class Wireman, standard rate.—Apply Secretary, Dulverton Electric Lighting Co., Dulverton, Somerset. 7882

SHIFT Engineer wanted for power house of large factory, must be fully conversant with the operation of steam turbines, reciprocating engines and 3-phase generating plant. Eight-hour shifts. Permanency to suitable man.—Reply, giving full particulars of age and experience, to 7850, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer (Working) for private power station, London. One with experience of refrigeration preferred. Salary £4 2s per week.—8016, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STOREKEEPER required, with experience in electric motor and fitting stores. Should be well up in modern storekeeping systems.—Reply, stating experience and salary required, to 7973, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant required, wage to start £2 15s. 6d. (inclusive of all bonuses), per week, averaging 48 hours.—Apply, stating age and experience, with references, and when duties can be commenced, to The Manager, Corporation Electricity Works, Gordon Road, Winchester. 984

TEST Room Assistant required for best electrical instrument work. One with experience of suspending and testing sensitive galvanometers preferred.—Apply, stating experience, age and wages required, 7855, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TESTER required immediately, experienced in testing small D.C. motors up to 10 H.P.—Reply, stating experience and salary required, to 7971, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TRANSFORMER Designer required at once, good salary and permanent position to right man.—Apply, giving particulars of design, experience, &c., to Ferranti, Limited, Hollinwood, Lancs. 7772

TRAVELLER wanted for South Wales for wholesale electrical accessories. Apply by letter, stating age, experience, salary, &c. Only live men need apply.—Simpson, Baker & Co., Tramways Centre, Bristol. 1018

WANTED, an Electrical Assistant in consulting engineer's office. Must be two or three years out of apprenticeship or pupilage and well educated; experience in modern power schemes and mill and factory lighting essential. Excellent prospects for suitable man.—Apply, in confidence, to 1015, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, several Armature Winders, used to A.C. and D.C. work; Standard rate paid, plus 12½%. None but first-class men need apply.—6780, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, the services of a capable Catalogue Compiler: one used to the setting up of Electrical Catalogues dealing with all kinds of electrical material. Replies should be accompanied with examples of work, and full details as to career, salary required, and when at liberty.—7843, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, the services of a capable Chief Assistant, to act as deputy to Sales Manager. Applicant must have experience in organisation and the control of staff.—Write, giving outline of career and salary required, to 7844, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WIREMAN wanted, for works and house installations; used to all systems. Permanency to a good man.—Cheel, 32, Montrose Avenue, Kilburn, N.W. 6. 894

YOUNG Laboratory Assistant required in the electrical department of the Borough Polytechnic Institute, Borough Road, S.E. 1. Must be capable of looking after apparatus and doing simple repairs.—Apply by letter, stating age, experience and weekly wage required, 7997, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

APPOINTMENT FILLED.

ADVERTISER, Box 7491, thanks applicants, and begs to state that a suitable candidate has been chosen and communicated with. 7987

SITUATIONS WANTED.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A.M.I.E.E. (29) desires post. Good technical training and experience in lamp works. Accustomed to handling girl labour.—911, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER (age 19), requires training under Government scheme, any branch electrical engineering. Knowledge incandescent lighting, dynamos, &c. Go anywhere, willing, reliable, good education, excellent references.—Priest, 111, Francis Avenue, Southsea. 886

ADVERTISER desires to place his son (age 16) as an apprentice, with a good firm of electrical engineers.—A. Burr, 50, Mildmay Road, Bootle, Liverpool. 937

ADVERTISER, ex-R.E. officer, single, 33 years of age, physically fit, public school, desires appointment in this country. 13 years' engineering experience before the war; A.M.I.E.E. Held responsible position for seven years in India (assistant manager) but resigned to come home to join the Army. Not desirous going abroad. Accustomed to interviewing, estimating and correspondence. Interview solicited.—829, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Estimator. Situation wanted by keen and ambitious young man with electrical engineering or contracting firm. Practical experience with power, lighting and generating installations, good knowledge of A.C. and D.C. theory, used to technical correspondence and some knowledge of machine drawing. Nominal salary to commence.—971, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

BUYER (30) desires a change; 12 years' first-class commercial and technical experience; highest references.—847, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer at liberty, central, sub-station, mercantile marine, naval experience, first-class certificate, seeks Shift or Assistant Maintenance appointment.—853, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMMERCIAL Assistant (30) seeks position in purchasing or sales department: thorough knowledge of electrical supplies, 12 years' experience, contractors and factors, accustomed purchasing and sales quoting, ordering, costs, correspondence, &c.; excellent references.—875, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DISTRICT Engineer or Sub-Station Attendant, just demobilised, seeks situation, two years' D.C. experience, five years A.C., E.H.T. and H.T. sub-stations, age 25. South-Western or Southern counties preferred.—L. G. Footner, Burley, Brockenhurst, Hants. 952

ELECTRICAL Apparatus Designer seeks position as Chief Draughtsman or Checker on the manufacturing side; eight years' workshop and 12 years' drawing office experience on apparatus, including three years' jig and tool drawing office experience for production of telephone parts, &c., honours City and Guilds of London, diploma for telephony, three years chief draughtsman and technical expert.—860, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, B.Sc., A.C.G.I., A.M.I.E.E., 11 years' experience design, manufacture and testing switchgear and plant, consulting and inspecting, desires post.—828, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, with large continental experience, 15 years cable works, expert salesman, at present representing British firm on the continent, desires change, either at home or abroad; good linguist and first-rate commercial experience.—968, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (31 years) seeks any position of trust; 15 years' workshop experience in all classes of switch and control gear and switchboards; energetic, keen and ambitious, of good appearance, and sound education; could produce excellent references of my character and general behavour; London district, or would travel.—R. B., 76, South Ealing Road, Ealing, W.5. 9'1

ELECTRICAL Engineer (31 years) seeks situation as Foreman; 15 years' practical experience all classes switch and control gear. Capable of handling men. Not afraid of work. Disengaged. London district.—R. B., 76, South Ealing Road, Ealing, W.5. 880

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer (35), married, just demobilised, 14 years' practical and technical experience, requires responsible position, home or abroad, erecting, testing, construction D.C. switchgear machinery, including turbo-generators, &c.—8, Cromwell Avenue, Highgate, London. 909

ELECTRICIAN Assistant requires situation, London preferred. C. Burston, 8, Mendip Houses, Globe Road, Bethnal Green. 1012

ELECTRICIAN, 28 (married), experience covers erection and maintenance steam and oil-driven plants. Late superintendent electrical and mechanical works, Bannu, India, 2½ years; excellent references. Post in power house or private generating station, London or South preferred.—Address Tarry, The Cross, Ticehurst, Sussex. 890

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ENGINEER, with many years' practical experience in country-house plant is desirous of getting occasional or part-time employment; testing, inspecting and reporting from London.—891, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Electrician (39), thoroughly experienced A.C. and D.C. erection and maintenance of estate and factory installations and water supply, seeks responsible post, at present foreman.—W. G., 49, Rosedale Road, Forest Gate, E. 7. 867

EX-OFFICERS' Employment Bureau. A voluntary organisation for helping the returned fighting men. Employers are asked to send details of vacancies to the "X.M. Buro," Dashwood House, E.C. 2. Selected lists of young ex-officers with good records and high educational qualifications promptly supplied. 7230

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A LONDON firm of manufacturing Electrical Engineers and Wholesale Suppliers are open to appoint Sole Agents in the following districts for some special lines in Electric Heating and Cooking Apparatus, Vacuum Cleaners, &c.:—Glasgow, for Scotland; Plymouth, for South-West of England; Bristol, for West of England; Cardiff, for South Wales. Applications will only be considered from firms of standing and repute who are in a position to handle a large amount of business.—8017, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(Continued on next page.)

AGENCIES.—*Continued.*

NOTICE TO MANUFACTURERS OF ELECTRICAL ACCESSORIES.

A WELL established firm with office and stores in Cardiff, a good selling organisation, principals well known in South Wales and West of England, require a sole selling agency for electrical accessories in South Wales.—7,923, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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ENGINEER'S Agent required to introduce well-known range of special labour-saving hand-power and light machine tools. Only those having good connections with engineering works and merchants will be considered. Applications, which will be treated in confidence, should give full particulars as to selling facilities, territory covered, &c.—Write Box T.T. 128, Dorland Agency, Ltd., 16, Regent Street, London, S.W. 1. 7910

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FOR SALE.

14" × 16" Ormerod Crank Shaping Machine.
10 nearly new 27" New Century, heavy duty, Vertical Drilling Machines.
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12" centres, S.S. and S. Lathe, on 12' straight bed, by the Canadian Machinery Corp.
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ONE 250-H.P. Belliss Engine with dynamo, 220 volts, 420 R.P.M.

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One Willans Surface Condenser, having cooling surface 3700 sq. ft., complete with steam engine and pump, and Edwards type air pump.

One 150-KW. Generating Set, two-crank compound Reavell engine, 270 B.H.P., 150 lbs. pressure, D.C. generator, 460/500 volts, 350 R.P.M., either shunt or compound wound. 5277

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FOR SALE.—*Continued.*

MACHINERY FOR SALE.

TURBO-GENERATORS, D.C. AND A.C.

One 1,000-KW. B.T.H., 440 volts, 50 period, three-phase, with condensing plant complete.
One 1,000-KW. Willans-Parsons-E.C.C., 6,600 volts or 3,300 volts, 50 period, three-phase, with surface condensing plant complete.
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One 500-KW. Parsons, 460/530 volts, D.C., with condenser.

GENERATING SETS, D.C. AND A.C.

One 500-KW. Belliss-B.T.H., 220 volts.
400-KW. Browett-Schuckert 220/230 volts D.C.
230-KW. Browett-Schuckert 220/230-volt D.C.
Two 225-KW. Belliss-Siemens, 220 volts, with condenser.
One 200-KW. Brush, 3 000 volts, 50 period, three-phase.
One 135-KW. Belliss-Silvertown, 220/230 volts.
One 100-KW. Belliss-Crompton, 110 volts.
One 75-KW. Sissons-E.C.C., 110-volt.
Two 1-KW., 110-volt, Robey-Electromotors, Ltd.

MOTORS, A.C. AND D.C.

One 150-H.P. Crompton, 25 period, three-phase, slip-ring, 1,450 revs.
Five 20-H.P. B.T.H. 460/480 volts D.C., 600 revs., with Brook-Hurst Starting Panels.
One 13-H.P. Laurence, Scott, 460 volts.

All the above are ready for immediate inspection and despatch. The motors are complete with starters and pulleys, and in most cases slide rails.

Apply FRANK GILMAN, 9, Westfield Road, Birmingham.
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GENERATING SETS FOR SALE.

TWO GENERATING SETS each consisting of Belliss Vertical Enclosed Triple Expansion Engine, direct coupled to a Multipolar Compound-wound Generator, by British Westinghouse Co., Ltd., having an output of 400 KW., at 500/560 volts, 325 R.P.M.

THE PHŒNIX ELECTRICAL CO., LTD.,
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7907

NON-STANDARD INDUCTION MOTORS.

THE BRITISH THOMSON-HOUSTON CO., LTD. Rugby, have the following Non-Standard Induction Motors in stock, of which prompt delivery could be made:—

H.P.	Phase.	Cycles.	Volts.	R.P.M.	
2	2	50	2 40	1430	Squirrel cage.
25	2	50	200	1460	" "
48	3	50	400	360	Slip-ring.
60	3	50	525	1450	Squirrel cage for direct coupling only.
100	3	50	440	2890	Squirrel cage.
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Apply, SUPPLY DEPARTMENT, The B.T.H. Co., Ltd., Rugby. 7976

DIESEL-DRIVEN GENERATORS.

400/500-KW., D.C., 500 or 250 volts, 350 R.P.M.; in excellent condition. Low price. Engines and Dynamos could be sold separately. Also two 500-KW. Parsons Turbines, 230 volts, D.C., complete with spare armature and condenser.

JENNINGS, West Walls, Newcastle-on-Tyne. 6820

1,000-KW. TURBO SET WITH CONDENSING PLANT.

TURBO-alternator Set with surface condensing plant, entirely new, for immediate delivery.
Steam pressure 156 lb., superheat 240 deg. F., alternator capacity 1,000 KW., 3,300, 550 or 2,000 volts, 50 cycles, 3,000 R.P.M.
7782, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

(Continued on next page.)

FOR SALE.—*Continued.*

FOR SALE.

16-H.P., 220-volt, slow-speed Holmes Motor, semi-enclosed, 6-pole, compound wound, 350 revs.
80-H.P., 3-phase, 50-cycle Motor, slip-ring type, speed 950, suitable for 440/500 volts.
75/110-volt, 32-amp. shunt Dynamo, suitable for coupling direct to Engine at 300/675 revs.
66-H.P., 450-volt, shunt wound Motor by Scott & Mountain, 1220 revs.
4-H.P., 110-volt, compound-wound Motor, by Holmes, slow speed, 300 revs.—DRUMMOND & Co., Middlesbrough. 5121

HIGH-CLASS 220-VOLT D.C. MOTORS IN NEW CONDITION.

THREE 20 H.P. shunt, protected, Royce Motors, speed 700. Six 16 H.P. compound, ventilated, Mather & Platt Motors, speed 370.
Two 6½ H.P. compound, protected Motors, by Electromotors, speed 650.
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Brook Hirst Starting Panels for most of the above from stock.

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Middlesbrough. 7892

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MACHINES always available for Sale or hire.
ARMATURES and FIELD COILS rewound or repaired without delay.

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A REGISTER OF MOTORS, &c., for sale and wanted. Send particulars of YOUR NEEDS (as a buyer or seller). MOTORS rewound and repaired.

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Cheap prepaid advertisements are inserted under this heading at the rate of 2d. per word per insertion.

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D.C. and A.C. Motors and Switchgear for Sale, ¼ to 20 H.P.—'Phone Holborn 1291. 980

ACHESON Graphite Electrodes for electric furnaces, surplus stock of 13¼ tons, size 10 in.; also 1½ tons 6 in. for disposal.—Apply to Kryn and Lahy Metal Works, Ltd., Letchworth. 8001

BALANCER Set, by Electromotors, out-balance current 200 amps., in mid-wire, three-wire, 230/115/230-volt system, complete with regulator and starter.—Harry H. Gardam & Co., Limited, Staines. 8010

DYNAMO, 150-KW., 110 volts, 180 R.P.M., 8-pole, 2 bearings, shunt wound. 58 H.P. Phœnix, 460 volt, shunt-wound Motor, 1,100 R.P.M.—Martin, 320, Witton Road, Birmingham. 959

DYNAMOS (several), 220 volts, D.C. compound, interpole, excellent condition, 330 R.P.M.; also D.C. Motors, all sizes to 90 H.P., 220 volts, very low price; also Balancers, all sizes.—Jennings, West Walls, Newcastle-on-Tyne. 6187

ELECTRIC Blower. One 3-H.P. Siemens Motor, 460 V. D.C., 2000 revs., direct coupled to Sirocco blower.—Bury Electrical Plant Co., Ltd., Phœnix Street, Bury. 7939

ELECTRIC Lamps.—Manufacturers of first-class tungsten electric lamps have factory throw-outs and odd sizes for sale. Very cheap, from 1s. 2d. each. Sound delivery guaranteed and good burning. Write for quotation giving particulars of voltages and candle powers required.—Storekeeper, Corona Lampworks, Ltd., Ascham Street, St. Pancras, N.W. 5. 559

ELECTRIC Motor, B.T.H., 5 H.P., 400-volt., starter and rails complete. Lowest price £47 10s.—A. H. Stanley & Co., Ltd., 151/2, Great Saffron Hill, E.C. 1. 10_{13}

FOR SALE.—*Continued.*

ELECTRIC Motors and Dynamos for Sale or Hire, D.C. and A.C. Machines always ready, guaranteed.—'Phone: 488 H'smith. The Electro-Generator Co., 1A, Shepherd's Bush Road. 868

ELECTRIC Motors.—5 H.P., 3-phase, 415 volts: 5 H.P. to 14 H.P., D.C., 400 to 460 volts; 5 H.P., slow speed, 400 R.P.M.—Morgan, 138, Gower Street, W.C. (Museum 3418.) 985

FOR immediate Sale, surplus Submarine Electric Battery. Overall dimensions of each cell, $17\frac{7}{8}'' \times 13\frac{7}{16}'' \times 42\frac{1}{16}''$ high. Weight of each cell complete about 900 lbs. Ampere-hour capacity of each cell: 1 hour rate, 2300; 4 hour rate, 3560; 12 hour rate, 4392.—For full particulars and facilities for inspection, apply Purchase Department, Vickers, Ltd., Barrow-in-Furness. 7897

FOR Sale, an Alternating Generator, 550 volt, 50 periods, 500 R.P.M., 175 H.P., by Scott & Mountain. £300 f.o.r.—Apply East Bristol Collieries, St. George, Bristol. 7969

FOR Sale, Balliss Generating Sets (two), 500 KW., 500 volts, direct current; available end of present month.—7845, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, eight new Control Panels, by Westinghouse, for 40-H.P., 400/440 volt, 50 cycle, 3-phase motors; £40 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7629

FOR Sale, nine 50-H.P., 400/440-volt, 600 R.P.M., enclosed Westinghouse D.C. Motors with starters. Nearly new. Price £246 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7514

FOR Sale, one Peel-Conner 100-line Telephone Switchboard with self-replacing indicators, suitable for local battery telephone work.—Apply Works Engineer, Austin Motor Co., Ltd., Longbridge Works, Northfield, Birmingham, 7810

FOR Sale or Hire, Motors and Dynamos, 440, 220, 110 volts. Electrical machinery of all kinds.—W. W. Martin, 320, Witton Road, Birmingham. 'Phone: East 883. 5775

FOR Sale, six new 1500-amp. Circuit Breakers, by Bertram Thomas; £15 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7630

FOR Sale, sixteen 10-H.P., 400/440-volt, 600 R.P.M., protected-type, D.C. Motors with starters. Price £78 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7516

FOR Sale, Special Double Commutator Generator, 110-KW., at 110 or 220 volts, or 80 volts, 50 periods, single, two or three-phase, 500 R.P.M.—The Phœnix Electrical Co., 32/36, Broomielaw, Glasgow. 6251

FOR Sale, three Generating Sets, each consisting of a "Gardner" 4-cylinder petrol or paraffin engine, coupled to 80-volt, 180-ampere, D.C. generator, nearly new, and complete with all fittings, including switchboards.—For price and further information apply Messrs. Fyfe, Wilson & Co., 31, Budge Row, Cannon Street, London, E.C. 7915

FOR Sale, three 200-H.P., 500-volt, 50-cycle, 485 R.P.M., 3-phase, slip-ring Westinghouse Motors.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7914

FOR Sale, two 10-H.P. and two 8-H.P. motor-driven Centrifugal Pumps with 400-volt, 50-cycle, 3-phase motors. £70 and £80 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7628

FOR Sale, two 100-B.H.P. protected type, slip-ring Motors, fitted with brush-lifting and short-circuiting device, wound for 220 volts, 50 periods single-phase, 950 R.P.M., with belt pulley 21" dia. × 18" face, with protected type stator starter and protected type rotor switch and resistances oil-immersed, and slide rails and holding-down bolts.—Brittain's Electric Motor Co., 110, Cannon Street, London, E.C. 4. 7619

FOR Sale, 43, new 5-H.P. 220-volt, 50-cycle, totally enclosed, three-phase, squirrel cage induction Motors, by Westinghouse, with oil immersed Star Delta Starters.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7427

FOR Sale, 43 new 5-H.P., 400-volt, 50-cycle, 710 R.P.M., 3-phase, squirrel-cage, totally-enclosed Motors by Westinghouse, with oil-immersed Star Delta Starters. £59 each.—The Phœnix Electrical Co., Ltd., 32/36, Broomielaw, Glasgow. 7632

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 70-B.H.P. and 120-B.H.P., three-phase, 50 periods, 3,000 volts, 480 R.P.M., slip-ring Motors. Westinghouse, with brush lifting device.—7998, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 120-H.P., 500-volt, 50-period, 720 R.P.M., 3-phase, squirrel-cage type Motor, with auto-transformer starter, £200. —The Phœnix Electrical Co., 32/36, Broomielaw, Glasgow. 5888

GAS Compressor, rotary type, "E" size, by Keith, Blackman; chain-driven by 420-volt, 3-phase, 50 periods, squirrel cage Motor.—7942, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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IMMEDIATE Disposal.—Three new Electric Motors. One 48-H.P., S.P., 220 V., S.C., Langdon-Davies, complete starter, resistance, slide rails. One 12-H.P., three-phase, 440 V., S.C., Langdon-Davies, complete 3-p., S.D. starter. One 5-H.P., three-phase, 440-volt, S.C., Langdon-Davies, complete S.D. starter.—Offers to 7985, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MOTOR, 5 H.P., 440 V. modern shunt, £48; 2½ H.P. Ditto, 760 revs., £48; 13 Storage Cells 47 amps., actual; also set 67 and 90 amps. All new, cheap.—Binns, 5, Osborne Terrace, Gosforth Newcastle. 1014

NEARLY New Belliss & Morcom, 550-H.P. enclosed vertical compound high-speed Steam Engine, latest type. New 1914. Two 50-B.H.P. Ruston Crude Oil Engines.—Full particulars, Harry H. Gardam & Co., Ltd., Staines. 8011

ONE type T British Vacuum Cleaner, Booth's patent, complete with all cleaning accessories: fitted with ½ H.P. 100 volt. D.C. motor and starter; almost new, £45 10s. One 12-volt car-lighting Dynamo, with Switchboard. Also 2-ton, 1-ton, 10-cwt., and 5-cwt. Morris make chain blocks, shop soiled.—J. Booth & Co., 420, Attercliffe Road, Sheffield. 7686

ONE 5-H.P. Vickers D.C. Motor, 220-volt, 1380 R.P.M., with starting panel.—Apply Accles & Pollock, Limited, Oldbury, Birmingham. 7978

PUMP Motor. 20-H.P. Rhodes Motor, 220 V. D.C., direct coupled to Cherry's 4" Vertical Sinking Pump, 300 gallons per minute, 100 ft. head.—Bury Electrical Plant Co, Ltd., Phœnix Street, Bury. 7940

SERIES wound crane Motors, two 35-H.P. and one 25-H.P., 500 volts; also quantity of Controllers and Resistances.—Garty, 47, Pitt Street, Glasgow. 1005

SINGLE-Phase Motors; three 25-H.P. squirrel cage Motors, 220 volts, single-phase, 50 periods, 950 revs.—7943, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SUPERHEATER for Sale, separately fired, capable of superheating 20,000 lbs. of saturated steam per hour, at a pressure of 160 to 200 lbs., to a temperature of 630° F., complete with all accessories, little used, in first-class order.—A. C. Cramb, Electricity Works, Factory Lane, Croydon. 7209

TOOL Steel (high speed and ordinary carbon) for sale over 1920. Enquiries invited from buyers of one ton and upwards.—Apply The Reliance Steel Works, Ltd., Cross Street North, Wolverhampton. 7974

TWO 20-KW., B.T.H. Generators, 250 volts, 80 amps., 700 R.P.M., 4 pole, compound wound with two pedestal bearings. Could be used as motor.—1009, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TWO 170-KW. Belliss-Siemens Generating Sets, 220 volts, 750 amps., 380 revs., cylinders 12" and 20" × 16" stroke, spare armature.—Harry H. Gardam & Co., Ltd., Staines. 8018

VARIABLE Speed Motor, 25 H.P., by Parker, 440 V. D.C., 4 poles with interpoles, 350/600 revs., with pulley, rails and starter. —Bury Electrical Plant Co., Ltd., Phœnix Street, Bury. 7941

8/10-H.P. Crossley Gas Engine, with Dynamo, by Mather & Platt, 100 volts, 180 amps., 1000 revs., complete with switchboard, &c. What offers (coupled or separately)? Accept £180, or would sell separate. Also ½-H.P. Robinson Gas Engine, with two lines of strapping about 8 ft. long, with brackets and all complete. What offers? Buyer to remove at own expense. All at Manchester.—Address H. S. Jackson, 51, King Street, Manchester. 981

10 CWT. Woolwich Tape, ½", ¾" and 1". Special offer accepted to clear. Available for inspection.—954, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR SALE.—*Continued.*

12-KW. D.C. Steam Generating Set, by G.E.C., 110 volts, 4-pole Generator, in nearly new condition, modern type.—Harry H. Gardam & Co., Limited, Staines. 8009

23 20-H.P., 440 volts, 3-phase, 25 periods, slip-ring, 710 R.P.M. Motors, by Westinghouse, with Itchin pillar starters, almost new, cheap.—Robert Walker, 2, Oswald Street, Glasgow. 7862

150-KW. Generating Sets (two) Belliss-Siemens, 440/500 volts D.C., 375 revs. Generators bipolar type.—7944, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

220-VOLT Shunt Interpole Motor, 30 H.P., 1000 R.P.M., by Cutting Bros., starter, £97 10s.—140, Southwark Street, S.E. 903

400-KW. D.C. Generator, 425 revs., compound wound, rope drive.—Harry H. Gardam & Co., Limited, Staines. 8007

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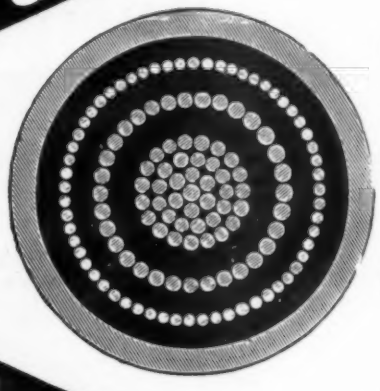

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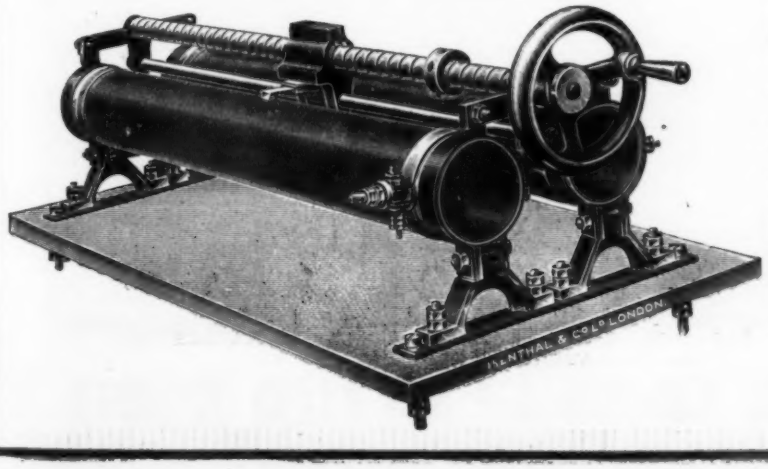

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Safe, Simple, Efficient and Economical. No waste heat.

Carron Electric Irons are beautifully finished and nickel-plated. Heating element is firmly fixed between machined surfaces of sole and clamp.

Upright is separated from the iron (except at the fitting points) by an air gap, ensuring a perfectly cool grip.

A stand is attached to each Iron, which allows the Iron to be placed upright.

Supplied complete with a strong double-pole connector, six feet of flexible cord and a B.C. adaptor, ready for connecting to lampholder.

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CARRON COMPANY *Works:* Carron, Stirlingshire.

Branch Works: Phœnix Foundry, Sheffield.

On view at the following Showrooms: London (City and West End), Liverpool, Glasgow, Edinburgh, Bristol, Newcastle-on-Tyne and Birmingham.

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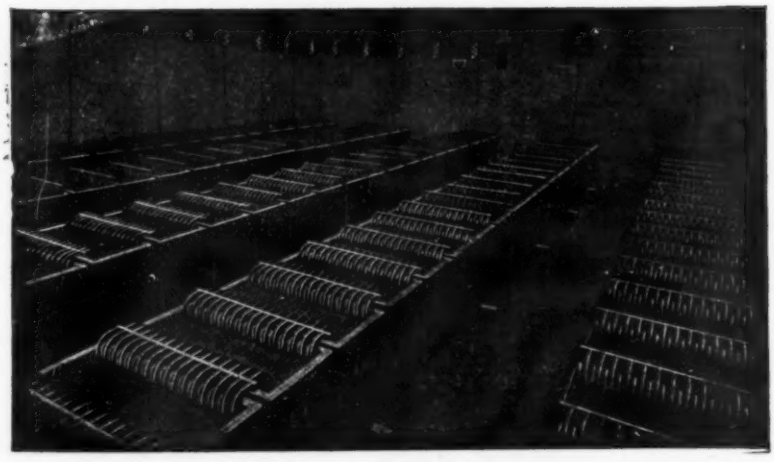
LIMITED,

STRATFORD, LONDON, E.



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LOW MAINTENANCE COSTS.

SUPPLIED TO ALL PARTS OF THE WORLD.

Write for Catalogue.

STORAGE CELLS FOR ALL CLASSES OF ELECTRIC LIGHTING.

OFFICIAL NOTICES.

Latest time for receiving, 5 p.m. Wednesday.

COUNTY BOROUGH OF HALIFAX.

TENDERS are invited for the supply of the following Stores and Materials required in the Electricity Department of the Halifax Corporation during the period February 1st, 1920, to March 31st, 1921, viz.:—

Schedule No.
1. Timber.
2. General Stores, including Ironmongery (such as Hack Saw Blades, Screws, &c.), Cleaning Materials, Brushes, Gauge Glasses, Rubber Garden Hose, and Block Tin.
3. Lighting Fittings and Electrical Accessories, including Lamps, Switches, Tapes, &c.
4. Cables, Vulcanised Rubber, and Phosphor Bronze, Telephone Wire.
5. Cables, E.H.T., 6,600 volts.
6. Cables, Low Tension, Lead-covered, and Armoured.
7. Iron Castings.
8. Tubes and Fittings.
9. Meters (Alternating and Direct Current).
10. Oils.

Samples may be seen on application to the "Stores," Victoria Street East, from Monday to Friday, December 22nd to 26th, and from December 29th to 31st, 1919, between 9 a.m. and 4 p.m. each day.

Forms of Tender and full information may be obtained at the Office, Foundry Street, Halifax. Intending contractors must state the *number* of the schedule required. Duplicate copies of each schedule may be obtained on application, on payment of 1s. per copy.

Tenders, in envelopes provided, must be sent to the undersigned on or before MONDAY, JANUARY 5th, 1920.

Any sample submitted by tenderers (which will not be paid for by the Corporation) must be marked "Sample. Tender for Electricity Stores," and sent to the Borough Electrical Engineer's Office, Foundry Street, Halifax.

The persons whose tenders are accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
PERCY SAUNDERS,
Town Clerk.

Town Hall, Halifax.
December 10th, 1919. 7894

ELECTRIC LIGHT INSTALLATION AT CAVAN.

TENDERS are invited for the following:—

Section 1.—Suction Gas Engine and Plant. Alternative tender for duplicates.

Section 2.—Electric Generator and Motor Booster. Alternative tender for Duplicate Generator.

Section 3.—Electric Storage Battery.

Section 4.—D.C. Switchboard.

Copies of Specifications can be had on application, accompanied by five shillings for each section, to cover cost of typing.

Forms of Tender supplied on application.

Intending contractors, not the manufacturers of the articles named in each section, must submit the name of a Guarantee Society to perfect a bond on their behalf.

Tenders must be posted to ensure delivery not later than JANUARY 12th, 1920.

The Company do not bind themselves to accept the lowest or any Tender.

PATRICK REILLY,
Cavan Electric Light & Power Co., *Hon. Secretary.*
Cavan.
December 16th, 1919. 7979

CORPORATION OF BRADFORD.

THE CORPORATION OF BRADFORD invite Tenders for the supply and delivery of two Electric Battery Locomotives, 60 cm. gauge, with a haulage capacity of about 10 tons on the level, delivered at their Apperley Viaduct Sidings, Apperley Bridge (Midland).

Further particulars may be obtained from Mr. JOSEPH GARFIELD, M.I.C.E., Esholt Hall, Shipley.

The contract will be let subject to the Fair Contracts Clauses of the Corporation.

Tenders, endorsed "Battery Locomotives," are to be delivered at the Office of the undersigned not later than 9 a.m. on WEDNESDAY, JANUARY 28th, 1920.

The Corporation do not bind themselves to accept the lowest or any Tender.

N. L. FLEMING,
Acting Town Clerk.

Town Hall, Bradford.
December 20th, 1919. 8004

OFFICIAL NOTICES—*Continued.*

COMMONWEALTH OF AUSTRALIA.

TENDERS are invited up to 3 p.m. on TUESDAY, FEBRUARY 10th, 1920, for the supply, delivery and erection of 340 accumulators required by the Postmaster-General's Department, State of Western Australia, in accordance with Schedule No. W.A.647.

Tender forms, &c., may be obtained, on prescribed conditions, at the office of the HIGH COMMISSIONER FOR AUSTRALIA, Room 406, Australia House, Strand, W.C. 2.

WILLIAM WEBSTER,
Postmaster-General.

Postmaster-General's Department,
October 29th, 1919. 7936

BOOTLE CORPORATION.

THE BOOTLE CORPORATION invite Tenders for the wiring of the first 34 houses under their housing scheme.

Tenders to be delivered at the Town Hall, Bootle, not later than noon, JANUARY 7th, 1920, endorsed "Wiring Tenders Housing."

Specifications can be obtained from the Borough Electrical Engineer, Electricity Works, Pine Grove, Bootle.

T. DAWSON CLOTHIER,
Borough Electrical Engineer.
7991

CITY OF MANCHESTER.

THE ELECTRICITY COMMITTEE of the Manchester Corporation are prepared to receive Tenders for the supply and delivery of the following:—

Specification No. 23.—One 2-ton Electric Lorry.
Specification No. 24.—One 10/15-cwt. Electric Van.

Specifications and forms of tender may be had on application to Mr. F. E. HUGHES, Secretary, Electricity Department, Town Hall, Manchester, on payment of a fee of £1 1s., which amount will be refunded on receipt of *bona-fide* tenders.

Further particulars and information can be obtained on application to Mr. S. L. Pearce, Chief Engineer and Manager, Dickinson Street, Manchester.

Tenders, duly endorsed and addressed to the Chairman of the Electricity Committee, must be delivered at the Town Hall not later than 10 a.m. on WEDNESDAY, JANUARY 14th, 1920.

The firms entrusted with these works will be required to enter into contracts to be prepared by the undersigned.

The Corporation do not bind themselves to accept the lowest or any tenders.

THOMAS HUDSON,
Town Clerk.

Town Hall, Manchester.
December 19th, 1919. 7989

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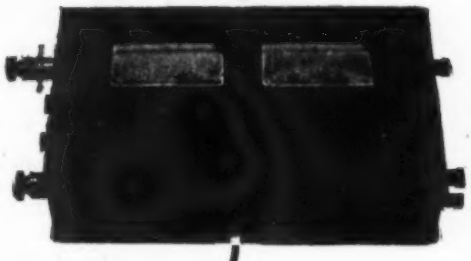
No better instruments of similar type are obtainable. They are self-contained. They possess three current ranges up to 100 amperes and three pressure ranges up to 600 volts. The windows are protected by metal covers. The movements are dead beat in action. They are designed for either continuous or alternating current.



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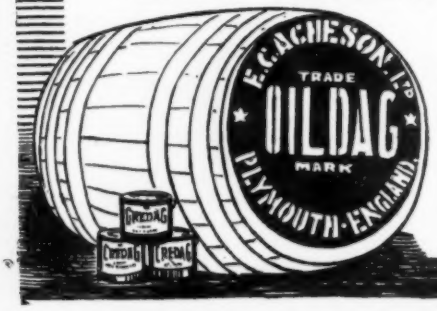

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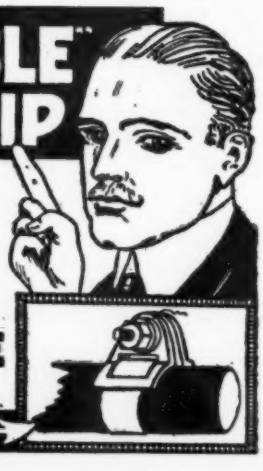

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We would like to inform them that our new January, 1920, List is now ready, which is full of interest, and our aim is to give you quality combined with low prices and quick delivery.

Yours faithfully,
Commercial Electrical Accessories, Ltd.,
A. W. J. Bedbrook,
Managing Director.

P.S.—A P.C. will bring you our 1920 List.

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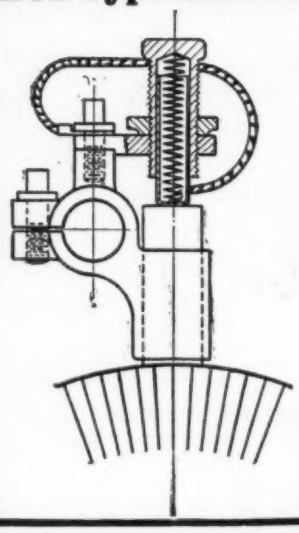

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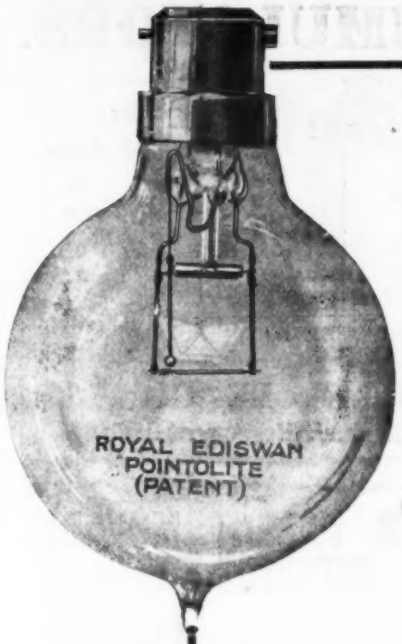

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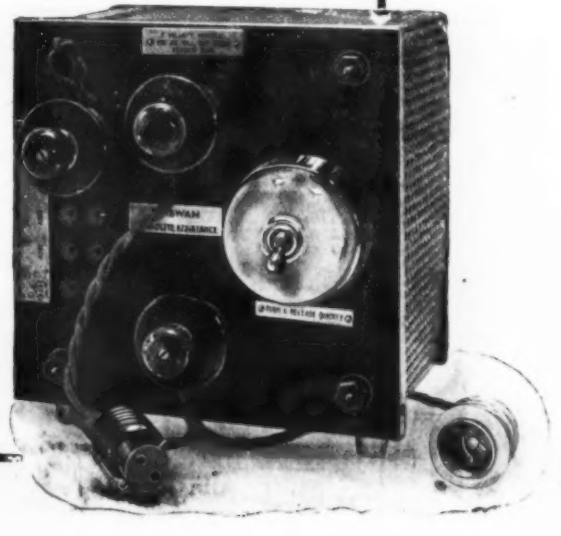

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Fig. 221.
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Fig. 231.

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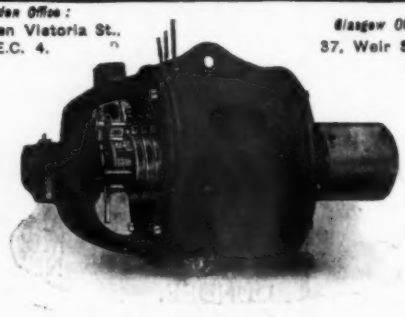
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Small Transformers for Lighting and Power and every purpose.

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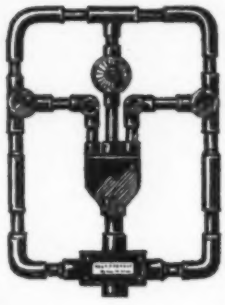

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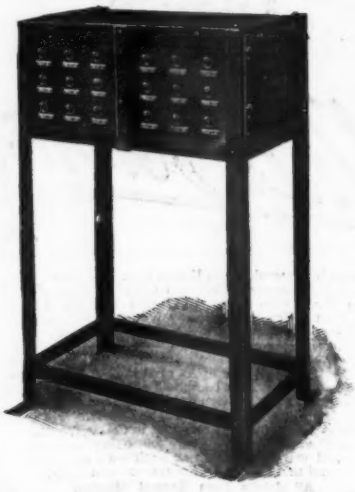

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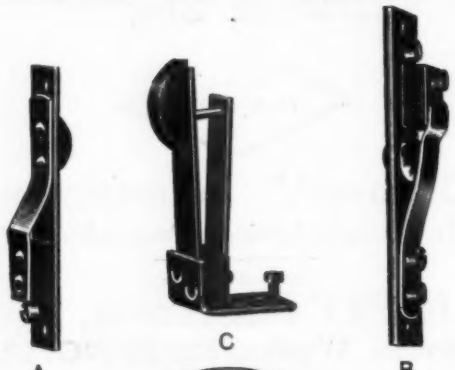

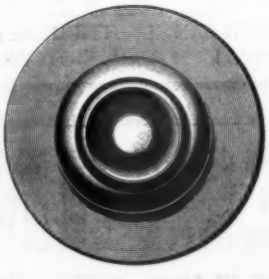

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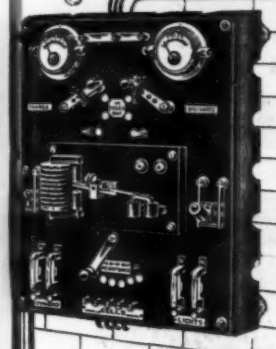

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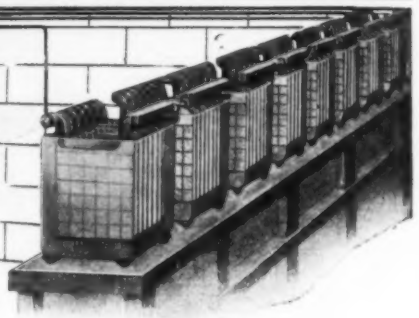

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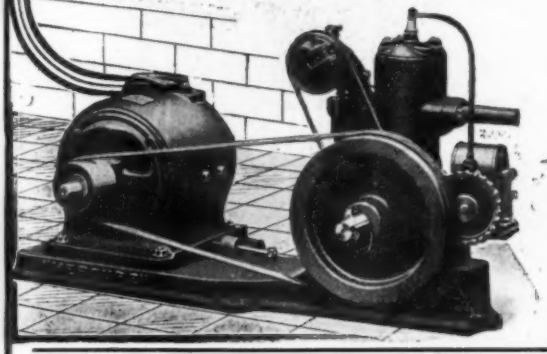
SWITCHBOARDS to work in conjunction with our Mercure Sets for Charging & Lighting Purposes.



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The Engine Set works very well and is running about 4 hours a day. It's a little beauty.

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Engine complete with Governor, Water and Fuel Tanks, Silencer, Injector, High Tension Magneto, Driving Belt, Shunt Wound Dynamo suitable for Lighting and Charging.

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MAGNETO IGNITION OF HIGH TENSION TYPE IS FITTED TO ALL ENGINES.

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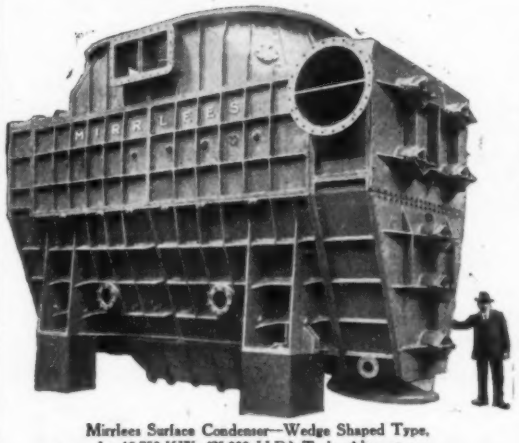

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HIGH VACUUM for steam turbine requirements produced economically and with absolute stability.

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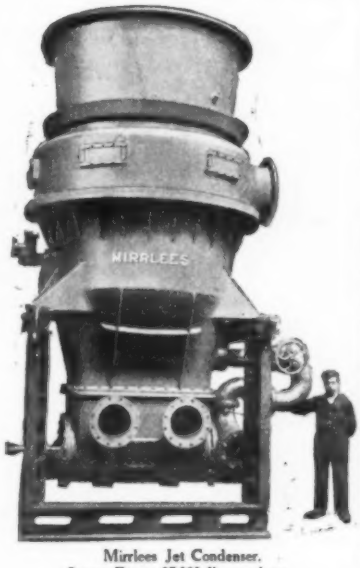

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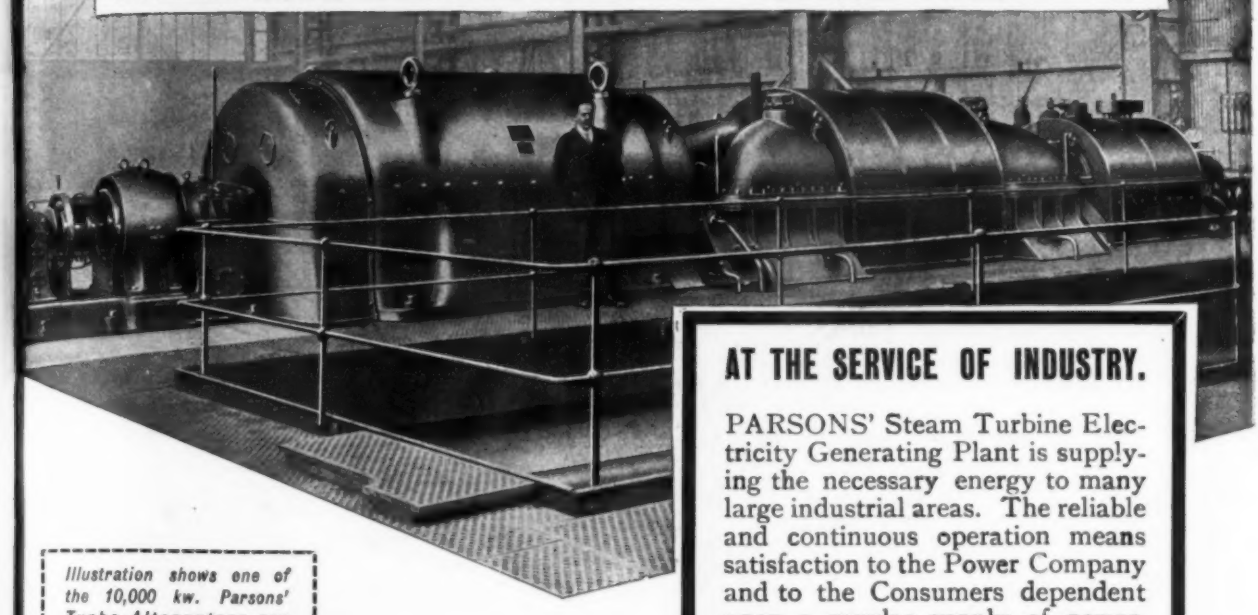

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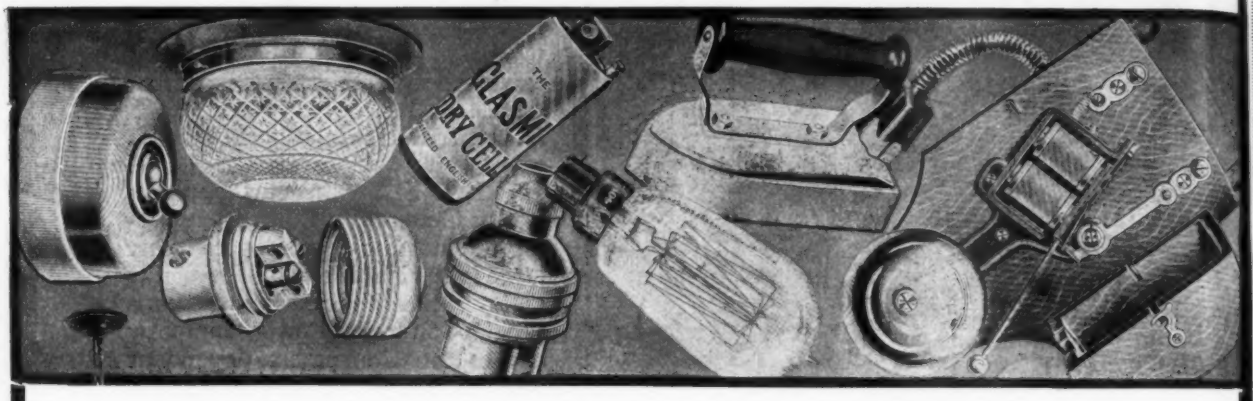

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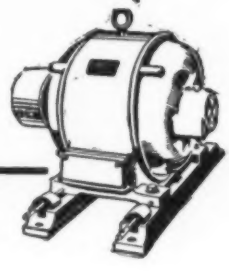

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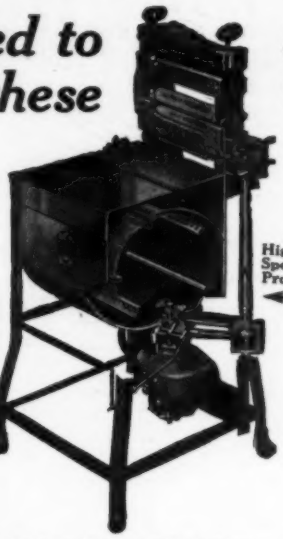
YOU are invited to see these  *give us a call to Goods.*

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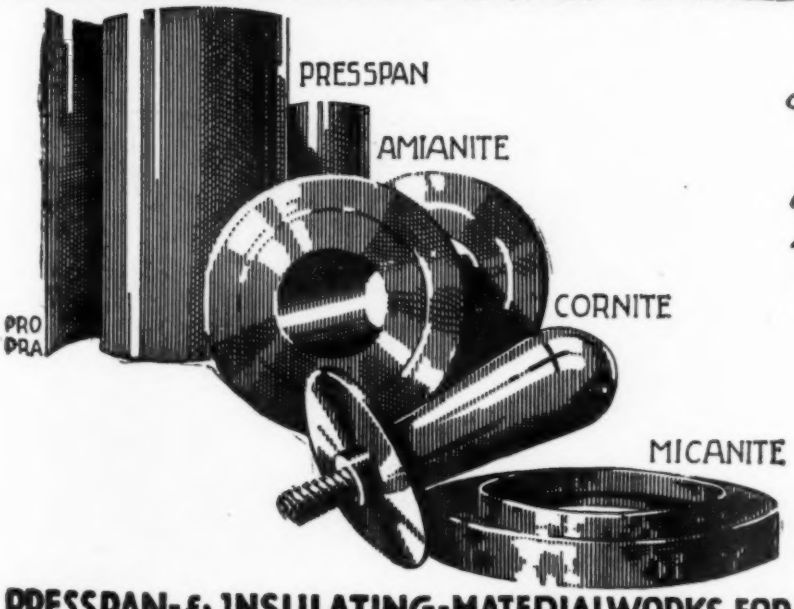

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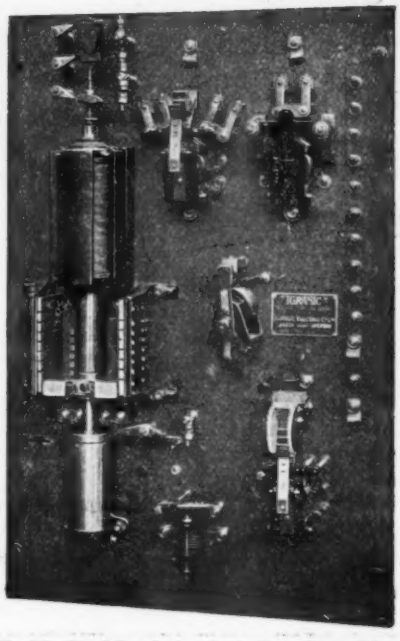

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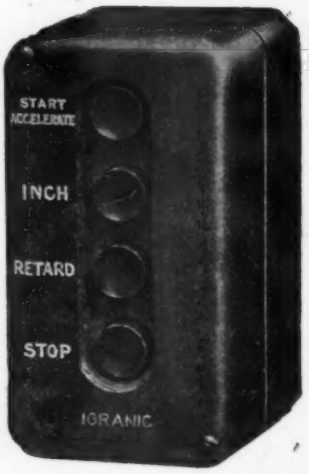

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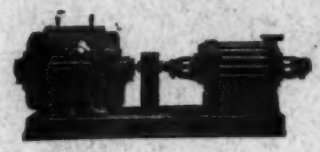

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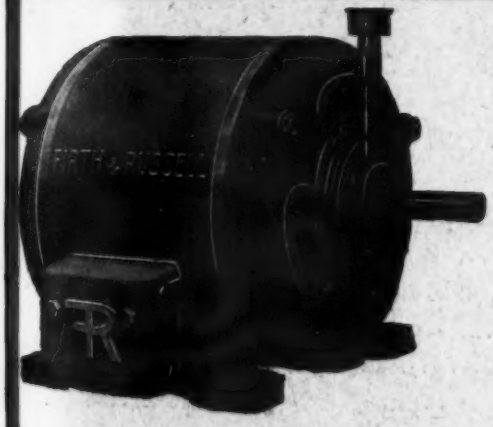

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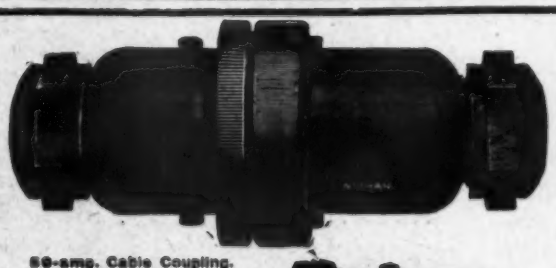

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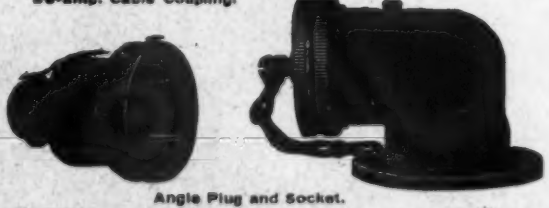

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